# Drainage Report and Stormwater Management Plan

# Tolles-Parsons Center

494-496 Washington Street (Route 16) Wellesley, Massachusetts

# Applicant Town of Wellesley

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# Wellesley, MA

Drainage Report

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# 1. Executive Summary

The Town of Wellesley is proposing the Tolles-Parsons Center, a new Senior Center to be located at 494 & 496 Washington Street (Route 16) (the Site) in Wellesley, Massachusetts.

This project consists of the construction of one building with associated site improvements, parking, landscaping, patios and walkways, stormwater mitigation and underground utilities.

The site currently consists of two lots on Washington Street. Lot #494 is a single family home with a detached garage and Lot #496 is a previously developed lot with only a paved driveway remaining. Combined, the Site is 41,963 square feet (0.96 +/- acres).

There are no rivers or wetlands associated with the Site or nearby and the Site is outside of any FEMA-FIRM 100 year flood zones or Natural Heritage areas of protected wildlife or vegetation.

This report addresses the drainage characteristics of the proposed project with respect to current and future stormwater runoff. It qualifies and quantifies the drainage mitigation with respect to stormwater runoff volumes, runoff rates, and stormwater quality as well as the addressing sediment and runoff controls during and after the construction process.

DeVellis Zrein Inc. (DZI) has analyzed the pre-development and post-development conditions of the project site and developed a stormwater management plan to mitigate the impacts resulting from the proposed project. The report addresses the stormwater maintenance protocol required to help ensure that the drainage system is maintained properly and achieve longevity and effectiveness. The proposed construction will increase the impervious surface area on-site and the stormwater management system has been designed to mitigate any increase in stormwater runoff to ensure that the post-development peak runoff rate from the site will be less than to the existing peak runoff rates. Regulations require an applicant to match the rate in which stormwater leaves the Site. DZI has been requested to provide a design to significantly reduce the rate and in addition, significantly reduce the volume of runoff leaving the Site onto abutting properties and Wellesley's drainage systems. The future stormwater runoff from the development area will be reduced with drainage improvements such as a closed piping system with catch basins equipped with a sumps and hoods, stormwater quality inlets and water infiltration basins or "rain gardens".

The future maintenance and upkeep of the site will be the responsibility of the Town of Wellesley. The stormwater design addresses ease of parking lot maintenance concerns while meeting the all of the state and town stormwater requirements and standards. Massachusetts Performance Standards and Regulations for Stormwater Management "Best Management Practices" have all been exceeded.

The following narrative provides a description of both the existing and proposed site conditions, and the methodology for design and implementation of stormwater management systems for the project.

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# 2. Existing Conditions

The project site is approximately 0.9 acres, located on Washington Street (Route 16) and is comprised of two separate lots to be combined during the permitting and development process. For the purpose of this report, the Site will be described as one site.

There are no Massachusetts Department of Environmental Protection (DEP) regulatory resources on site or within jurisdictional buffer limits. The site is serviced by Municipal water and sewer and there are no wells or on-site septic systems.

Two curb cuts access the Site from Washington Street.

The site is fully developed and can be generally described as residentially landscaped (driveway, single family home/garage, grass, single trees). One area of the site is comprised of a large level compact gravel parking area.

The topography is mainly flat with a 3-1/2 foot grade change across the Site. Approximately 2/3rds of the Site slopes from north to southwest towards Washington Street and 1/3rd of the Site slopes to the northeast corner of the Site. The elevation ranges from approximately 145-feet (ft) at the southwest corner of the Site to approximately 148.5-ft at the center of the site.

# Description of Contributing Area

The following is a brief description of the drainage area:

The analysis has been prepared to identify each existing drainage area and the design has been performed to reduce pre- and post- runoff conditions to each area.

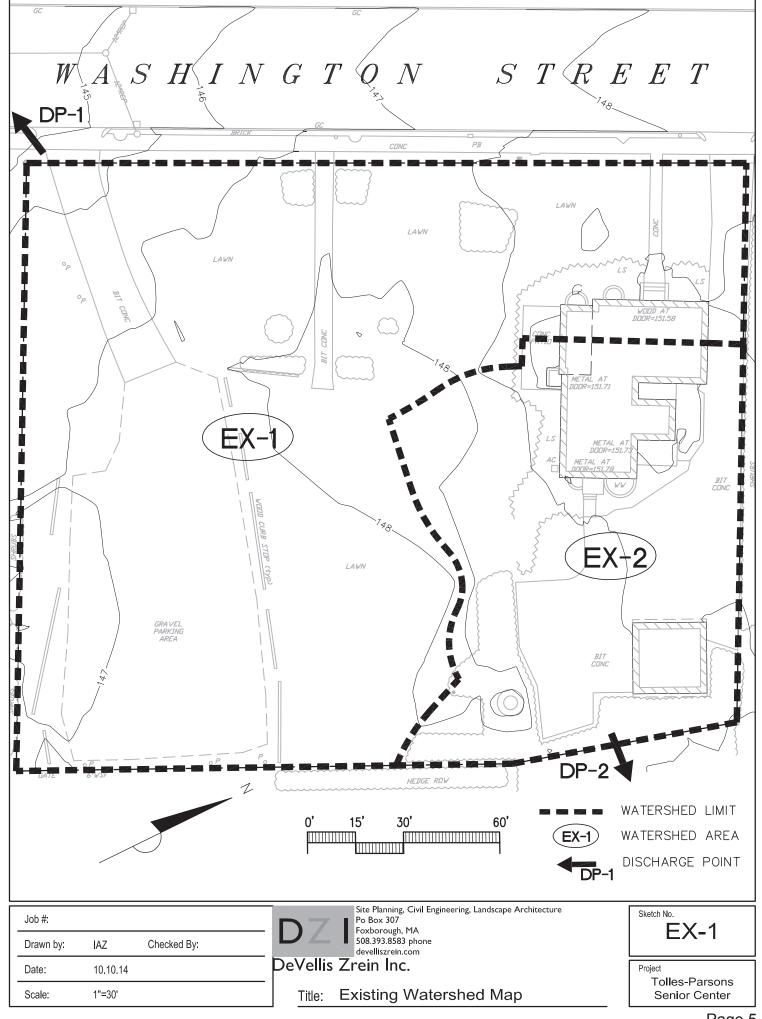
The existing development area is approximately 0.9 acres (Figure EX-1) and is categorized as with two distinct watersheds, EX-1 and EX-2. Watershed EX-1 is tributary to the Washington Street closed drainage system and EX-2 currently sheetflows towards the residential properties to the northweast.

DZI has reviewed the geotechnical data prepared by Soil Exploration Corporation and has performed additional deep hole test pits and percolation testing throughout the site to determine subsurface conditions and current and historic high groundwater levels on the Site.

For the purpose of this hydrologic analysis, the following assumptions were made:

- Whenever possible, the property line and/or an arbitrary line, outside the limit of proposed work are delineated as the watershed boundary.
- The total watershed area for the existing conditions is used as the comparison base for the watershed area in the proposed conditions.

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# Soil Conditions

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Middlesex County, Massachusetts. The site is comprised of one soil type, Type A. See copy of the SCS Soils Survey of Middlesex County at the end of this memo. The following table lists the soil designation, soil name and the soil group.

Table 1 - SCS Soil Types

Map Designation	Soil Name	Soil Group
626B	Merimac-Urban Land complex, 0-8 percent slopes	Α

## **Existing Drainage Area Summary**

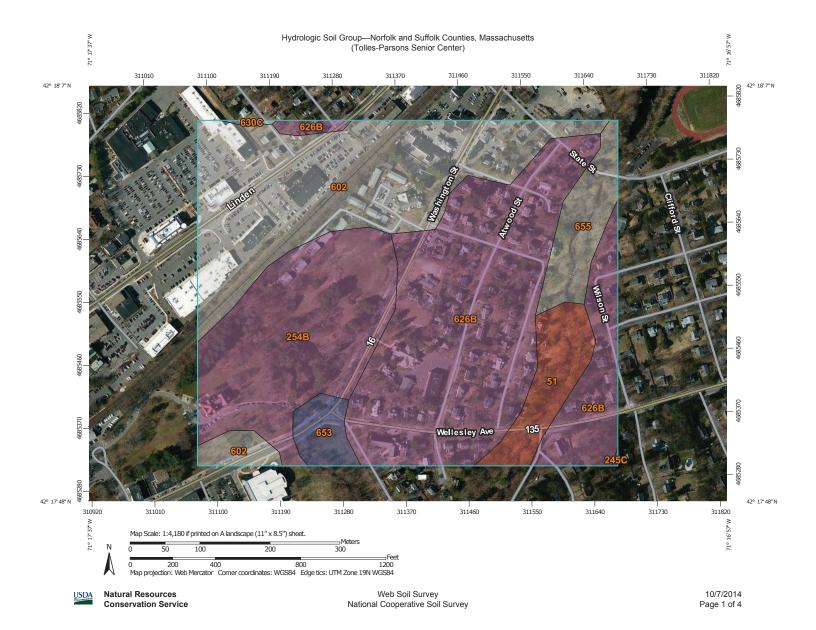
The following table summarizes the existing drainage area, including the pertinent information used for the hydrologic analysis:

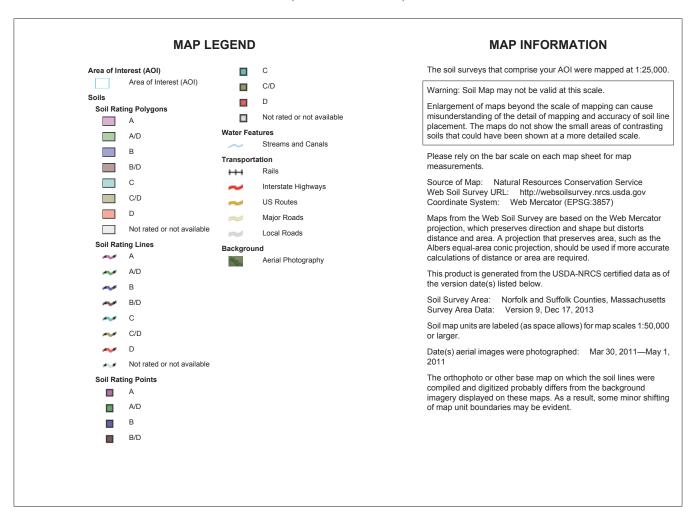
### **Existing Conditions Drainage Area - Characteristics**

Drainage	Area	Curve	Tc
Area	(acres)	Number	(min.)
EX-1	0.66	60	10.2
EX-2	0.28	76	6

### Peak Discharge Runoff Rates

The existing peak flow rates, tributary to the drainage point, were calculated for the 2, 10, 25 and 100-year storm events in accordance with guidelines given in DEP's Stormwater Management Policy and Wellesley's standards. Results are presented in the following section of this report. Refer to Existing Watershed Plan for a delineation of the watershed areas and their respective points of concentration.







Web Soil Survey National Cooperative Soil Survey

# **Hydrologic Soil Group**

Hydrologic Soil Group— Summary by Map Unit — Norfolk and Suffolk Counties, Massachusetts (MA616)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51	Swansea muck, 0 to 1 percent slopes	D	3.8	5.2%
245C	Hinckley sandy loam, 8 to 15 percent slopes	А	0.0	0.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	14.8	20.1%
602	Urban land, 0 to 15 percent slopes		21.1	28.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	28.5	38.6%
630C	Charlton-Hollis-Urban land complex, 3 to 15 percent slopes		0.1	0.1%
653	Udorthents, sandy	В	1.8	2.5%
655	Udorthents, wet substratum		3.7	5.0%
Totals for Area of Interest			73.9	100.0%

# **Description**

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

# **Rating Options**

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

# 3. Proposed Conditions

The proposed project consists of the construction of a two-story Senior Center building with associated access drives, parking, a pervious patio and walkways, rain gardens and landscaping, utility services and drainage improvements.

When impervious surfaces such as pavement and roof top are proposed, there will be an increase in stormwater runoff if mitigation is not provided. A stormwater management system is required to maintain the characteristics of the existing watersheds to the extent practicable.

Meeting current conditions are the requirement. Runoff rates at the discharge point are required to be maintained to existing conditions by temporarily holding runoff and slowly releasing it off site to meet existing peak flow rates.

For this project, the design request from the Town of Wellesley was to over-detain stormwater and reduce the runoff rate (speed of which stormwater travels) from the site as well as infiltrate larger volumes of stormwater on site to recharge the aquifer and reduce the burden on the municipal drainage systems. This results in a reduction of volume of stormwater leaving the Site. Although not a regulatory requirement, this request was made in order to achieve and set a higher standard in Town. In addition, the design was to provide separation of roof runoff from parking lot runoff and provide an easy to understand and maintain system that does not end up "out of sight, out of mind".

The stormwater objectives of this project are summarized as follows:

- 1. **Decrease** the **rate** of runoff by providing stormwater retention
- Decrease the volume of runoff by providing excess infiltration into the soil
- 3. **Provide** a safe and environmentally **sustainable solution** to infiltrate stormwater on site such as rain gardens and separated systems.
- 4. **Separate** pavement **runoff** from roof runoff
- 5. **Improve** existing runoff **conditions** for the Town of Wellesley and all abutters
- 6. Incorporate a stormwater system into aesthetically pleasing passive open space use
- 7. **Provide** a system that has **longevity** with minimal expense with a well understood maintenance protocol
- 8. Exceed proper engineering standards of Wellesley's DPW the DEP

The proposed development site will consist of two distinct watershed areas, PR-1 and PR-2 (Figure PR-1). Drainage area PR-1 is approximately 0.93 acres and will continue to drain into a closed drainage system within Washington Street at the southwest corner of the Site after the stormwater is mitigated. Drainage area PR-2 is approximately 0.03 acres and will continue sheetflow overland to the northeast in a similar, but reduced manner. Detailed description of each contributing area is provided below:

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### **Drainage Area PR-1**

Drainage Area PR-1 encompasses the majority of the site and contains all of the following stormwater mitigation items.

#### **Roof Runoff:**

The building's roof is pitched to the sides and collected. Stormwater runoff is considered clean and suitable for direct infiltration into the ground to provide groundwater recharge. The roof runoff will be collected and either piped directly to an on-site "rain garden" behind the building aside the pervious patio or directly to the on-site stormwater detention recharge system.

### Rain Garden (aside the pervious patio):

A Rain Garden is proposed along the southeast face of the Senior Center. The rain garden will support a variety of indigenous plants that can survive in wet and dry conditions. The top of the rain garden is flush with the surrounding grade and will provide easy access for garden enthusiasts. The location of the rain garden provides southern sun exposure and aesthetic opportunities for sitting and enjoying the quiet space. The rain garden is placed in an area that is not "out of sight/ out of mind" as it can be easily incorporated into the outdoor programming within close proximity to the pervious patio. This rain garden has been designed to collect and infiltrate stormwater, however this drainage analysis has not factored that into the calculations in order to provide a higher safety factor when calculating the reduction in runoff volumes and rates.

### Rain Garden (within the parking lot):

A Rain Garden is proposed within the main parking lot to capture stormwater as it sheetflows across the parking lot. The raingarden is planted with indigenous plants that filter pollutants. This rain garden has been designed to collect and infiltrate stormwater, however this drainage analysis has not factored that into the calculations in order to provide a higher safety factor when calculating the reduction in runoff volumes and rates.

### Catch Basins / Water Quality Inlets:

Where water cannot be collected by the raingardens due to grading and site constraints, catchbasins equipped with water quality units will capture, clean and route the stormwater to the onsite detention / retention basin.

#### **Detention / Retention Basin:**

An underground stormwater infiltration and retention basin is located in the southwest portion of the lot. This location has been chosen so scheduled maintenance and inspection will not interfere with the main lot's traffic circulation and also to collect the entire site's runoff before any water leaves the site.

It is equipped with oversized pipes and manholes to provide easy access and inspection.

The stormwater enters into the site and travels through a series of perforated pipes surrounded by washed crushed stone that allows stormwater to enter into the ground. During frequent storm events which cover about 80% of the storms in New England, stormwater does not leave the site at all and infiltrates into the ground. During less

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frequent events, stormwater is over-detained well above existing conditions. This basin dramatically reduces the runoff rates and volumes of stormwater leaving the site.

### **Drainage Area PR-2**

Drainage Area PR-2 encompasses the minor northeast corner of the site. The area continues to sheetflow toward the northeast perimeter of the Site in a reduced capacity due to the reduction in size. Peaks and volumes to this area are dramatically reduced.

### Proposed Drainage Area Summary

The following summarizes the proposed drainage areas, including the pertinent information used for the hydrologic analysis:

### **Proposed Conditions Drainage Area Characteristics Summary:**

Drainage Area	Area (Acres)	Curve Number	T <sub>c</sub> (min.)
PR-1	0.93	89	6.0
PR-2	0.03	39	6.0

### Peak Discharge Runoff Rates

The proposed peak flow rates, tributary to the drainage point, were calculated for the 2, 10, 25 and 100-year storm events in accordance with guidelines given in DEP's Stormwater Management Policy. Results are presented in the following table. Refer to Proposed Watershed Plan for a delineation of the watershed areas and their respective points of concentration.

### Summary of Results

As previously stated, the resultant post-development peak discharge rates for the discharge points are less than the pre-development peak discharge rates. The following table provides a summary of the pre and post development data. The following table demonstrates peak flows at the design points for each of the design storms has been met.

#### **Peak Rates of Runoff Leaving the Site:**

Location	2-Yea	r Storm	10-Yea	r Storm	25-Year	r Storm	100-Yea	ar Storm
	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
DP-1	0.16	0.00	0.72	0.34	0.95	0.49	1.64	1.15
DP-2*	0.35	0.00	0.75	0.00	0.90	0.00	1.29	0.01

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### **REDUCTION** of Peak Rates of Runoff Leaving the Site:

	2 year storm	10 year storm	25 year storm	100 year storm
	Peak Rate	Peak Rate	Peak Rate	Peak Rate
	Reduction	Reduction	Reduction	Reduction
DP-1	100%	53%	48%	30%
DP-2*	100%	100%	100%	99%

### **Volume Reduction**

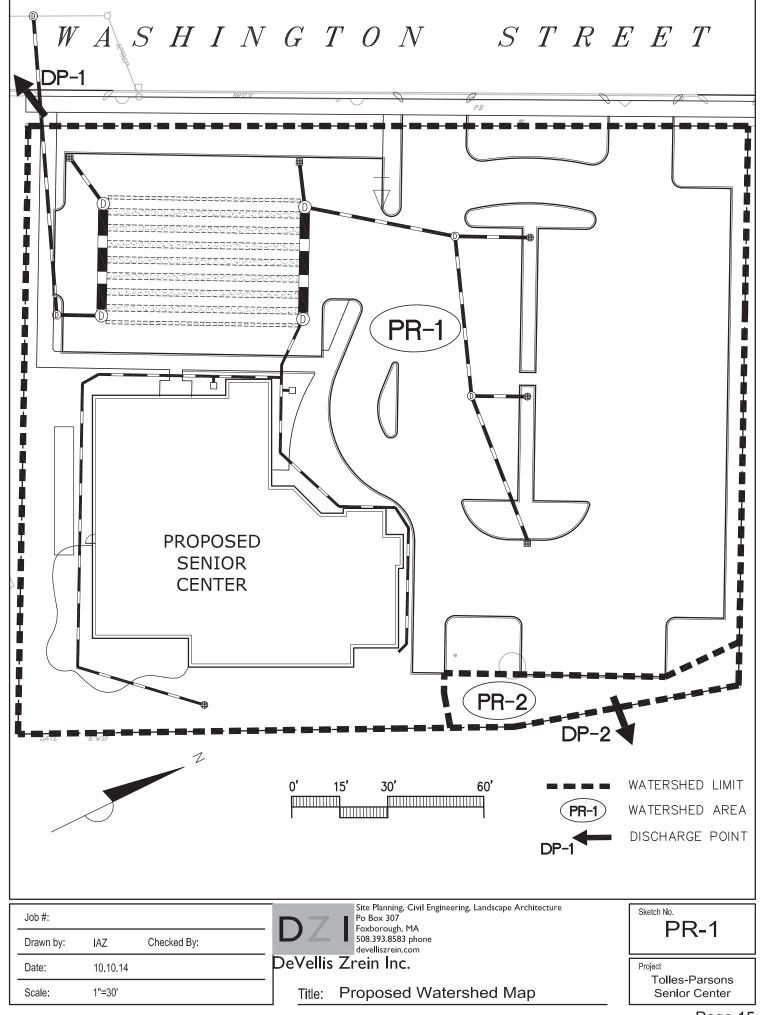
Peak rates of stormwater (how fast the water travels off site) are regulated and the requirement is to meet current conditions. Volume of water leaving the site is not regulated. DZI has been requested to reduce both the PEAK rate of runoff as well as the VOLUME of runoff leaving the site. The following chart reflects the reduction in volume leaving the site as a result of overdetaining the stormwater within the stormwater detention / retention system:

### **Volume of Runoff Leaving the Site:**

Location	2-Year	r Storm	10-Yea	r Storm	25-Yea	r Storm	100-Yea	ar Storm
	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop
	(ac ft)							
DP-1	0.023	0.000	0.068	0.030	0.086	0.046	0.141	0.101
DP-2*	0.027	0.000	0.055	0.000	0.065	0.001	0.094	0.002

## **REDUCTION** of Volume of Runoff Leaving the Site:

	2 year storm	10 year storm	25 year storm	100 year storm
	Volume	Volume	Volume	Volume
	Reduction	Reduction	Reduction	Reduction
DP-1	100%	56%	47%	28%
DP-2*	100%	100%	98%	98%



# 4. Methodology and Design Criteria Hydrologic Model

The drainage analysis was performed using the Soil Conservation Service (SCS) TR-20 method and the drainage software HydroCAD 7.10, as developed by Applied Microcomputer Systems. Data used in the design is as follows:

### **Design Storms**

Rainfall data for the 2, 10, 25 and 100- year frequency rainfall events (for a 24-hour precipitation) was taken from the Rainfall Frequency Atlas of the Unites States (TP-40). The following table outlines the rainfall used for the TR-20 method.

### **Rainfall Data**

Storm Event	Rainfall
2-Year	3.20 inches
10-Year	4.80 inches
25-Year	5.35 inches
100-Year	6.80 inches

### Time of Concentration

The 'time of concentration'  $(T_c)$  for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of concentration. The travel path was drawn based on the topography and the time was calculated using the TR-55 Method and HydroCAD. A minimum  $T_c$  of 6.0 minutes was used.

### **Curve Numbers**

Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the watersheds utilizing the SCS TR-55 method.

# 5. Department of Environmental Protection Stormwater Management Standards

**Standard 1:** No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The project does not propose any new untreated outfalls or discharge of untreated water into wetlands or waters of the Commonwealth. All proposed impervious surfaces will be collected and treated with a catch basin, water quality units, rain gardens and treated and detained on-site with a detention / recharge system.

**Standard 2:** Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The project will REDUCE the post-development stormwater peak discharge rate to pre-development conditions via infiltration pipes and a detention / recharge system. Although not a requirement, the project will REDUCE the post-development volume of runoff as well.

**Standard 3:** Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Standard 3 requires the restoration of recharge, using infiltration measures and careful site design.

The project will provide groundwater recharge. The infiltration provided within the detention / recharge system recharges stormwater back into the ground per the required amounts.

The NRCS classifies soils into four hydrologic groups, A thru D, indicative of the minimum infiltration obtained for a soil after prolonged wetting. Group A soils have the lowest runoff potential and the highest infiltration rates, while Group D soils have the highest runoff potential and the lowest infiltration rates. The required recharge

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volume, the stormwater volume that must be infiltrated, was determined using existing site conditions and the infiltration rates set forth below.

Hydrologic Group Volume to Recharge				
(Total Impervious Area)				
Hydrologic Volume to Recharge Total Impervious Area				
Α	A 0.60 inches of runoff			
B 0.35 inches of runoff				
С	0.25 inches of runoff			
D	0.10 inches of runoff			

The soils are defined by the Soil Conservation Services (SCS) Soil Survey of Middlesex County, Massachusetts. The site is comprised of one soil type. Based on the published mapping and confirmed with the on-site soil testing, it was determined that the developable areas fall entirely within category **A**.

# **Standard 4:** Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

This standard is met by this project:

- a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained:
- b) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The stormwater runoff from the proposed parking spaces will exceed the 80% TSS removal as the project is equipped with a catchbasins/water quality units with a sump and hood, a water quality structure and a detention / recharge basin.

A long term Operation and Maintenance Plan associated with this project has been designed and is included within this report.

## **Standard 5:** Regards land uses with higher potential pollutant loads:

This is Not Applicable.

**Standard 6:** Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

This is Not Applicable.

## **Standard 7:** Regards redevelopment projects:

Although this property is currently developed, for the purpose of setting a high standard, the waivers and lower thresholds allowed for meeting redevelopment standards have been waived and this project meets or exceeds all applicable standards for new development.

**Standard 8:** A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The Grading and Utilities Plan contains provisions for the construction related items such as silt fence, catch basin siltation controls, limits of disturbance, construction entrances and all related Erosion and Sedimentation notes and with Operation and Maintenance provisions for construction and post construction activities.

**Standard 9:** A Long -Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The Long-Term Operation and Maintenance Plan has been prepared within this report and referenced on the plans that include the routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks.

# **Standard 10:** All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. By acceptance of this document, the Town of Wellesley acknowledges that the stormwater management system is the system for conveying, treating, and infiltrating DeVellis Zrein, Inc.

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stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. This document shall serve as the Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and within the pollution prevention plan measures to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

# 6. Operation and Maintenance Plan

# Introduction

DeVellis Zrein Inc. has prepared this report as a guide to establish maintenance protocol for the on-site drainage improvements serving the Proposed Senior Center. The goal of the Storm Water Operation and Maintenance Plan is not only to protect off-site wetlands and water resources abutting the site, but also to protect those resources in the region that may be affected by the activities at the site.

The proposed site drainage improvements include:

- Catch basins with deep hoods;
- Water Quality Inlet
- Rain Gardens
- Pervious Patio Pavers
- Drain pipe network;
- Detention and Infiltration System

The proposed water quality treatment measures will result in improved removal of the total suspended solids (TSS) load in runoff from the site for the proposed parking improvements as well as throughout the existing parking areas.

An effective drainage maintenance program will ensure that the removal of TSS from the stormwater runoff continues for the life of the facility. The Operation and Maintenance Plan will be implemented by the Owner of the property.

# Source Control

The first tier of non-structural controls includes a comprehensive source control program of regular sweeping and maintenance of the stormwater management components.

# Pavement Sweeping Program

While certain types of street sweepers are not effective for the removal of fine particulates and pollutants associated with them, most are quite effective for the removal of large quantities of sand, grit, and assorted inorganic and organic debris. Larger material carried in storm water poses an environmental threat not only by degrading aesthetics, but may also contribute pollutants as it degrades over time. In addition, larger materials may clog conveyance systems, reduce the efficiency and longevity of treatment systems and ultimately result in more maintenance downstream. The removal of contaminants directly from paved surfaces before contact with storm water is a valuable method for reducing pollutant loading in stormwater.

It is proposed that the parking and drive areas will be cleaned with a street sweeper on a semiannual basis with at least two sweepings per year or more often as required

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if conditions require it. An alternative to a street sweeper is hand sweeping and hand held leaf blowers to collect and clean the parking lot as the area is relatively small. Sweeping at the end of the winter season is to remove sand applied during the winter which typically migrates to the edges of paved areas and once in the fall to remove debris and organics accumulated in the summer and fall seasons.

# Catch Basin

The new catch basins at the site will be equipped with sumps and hooded outlets to trap debris, sediments and floating contaminants, which are the largest constituents of urban runoff. The catch basin will be cleaned once per year or more often as required by the DPW if conditions require it. This practice in coordination with minimal use of sand and street sweeping comprises a multi-level source control approach that prevents sand/sediments and litter from exiting off-site and/or ultimately into the resource areas.

# Water Quality Unit

The new water quality units at the site will be equipped with specific catchment systems that will need to be cleaned per manufacturer's specifications. The water quality units will be cleaned during the same schedule as the catch basins.

# Rain Garden

The rain garden should be cared for like any flower garden with several exceptions. The plant selection has been made by a landscape architect and represents a selection that is indigenous to New England, can survive in wet and dry conditions with little use of fertilizers or excessive watering. The bottom strip of stone shall be maintained free of organics and dirt to allow infiltration. The inlet pipes or curb openings shall be kept clear of obstruction. Side slopes shall be kept planted and side erosion shall be avoided.

# Pervious Patio Pavers

While certain types of leaf blowers are not effective for the removal of fine particulates and pollutants associated with them, most are quite effective for the removal of sand, grit, and assorted inorganic and organic debris. Larger material carried in storm water poses an environmental threat not only by degrading aesthetics, but may also contribute pollutants as it degrades over time. In addition, larger materials may clog conveyance systems, reduce the efficiency and longevity of treatment systems and ultimately result in more maintenance downstream. The removal of contaminants directly from paver surfaces before contact with storm water is a valuable method for reducing pollutant loading in stormwater.

It is proposed that the pervious patio paver patio be cleaned with a leaf blower on a semi-annual basis (spring and fall), with at least two blowings per year.

# Detention and Infiltration System

The actual removal of sediments and associated pollutants and trash occurs only when inlets are cleaned out; therefore, regular maintenance is required. The stormwater that enters into the infiltration system will be devoid of sediment due to the TSS removal within the components leading up to the system. In order for sediment to reach the system, it would have to pass through the raingardens, catch basins and water quality inlets before reaching the infiltration system. All of the treatment components referenced provide a higher level of sediment removal than required and it is very unlikely that sediment will accumulate in the system. If sediment is observed in the system it can be easily removed with a vacuum truck similar to a septic system pumper.

The underground detention and infiltration basin has been designed with oversized manholes and pipes for easy access and viewing. The system is set at the southwest parking area away from the building access and circulation patterns so when the system has to be opened for inspection, it can be done without interfering with the building use. There are 6-foot diameter manholes at each corner of the system (4 total) and 36-inch header pipes along the sides connecting to 36-inch diameter perforated infiltration pipes, accessed from each manholes that are provided for easy viewing and maintenance.

# During Construction

- Prior to construction, install tree protection and erosion and sediment control measures as shown on the plan and details.
- The site contractor shall inspect all sediment and erosion control structures after each rainfall event and at the end of the working day.
- All measures shall be maintained in good working order. If repair is necessary, it shall be initiated within 24 hours of inspection.
- Silt shall be removed from the silt fence if 3-inches or greater and as needed.
- Sediment shall be contained within the construction site and away from drainage structures.
- Damaged or deteriorated erosion control measures will be repaired immediately after identification
- The silt fence shall be kept in close contact with the ground and reset as necessary.
- The contractor's site superintendent will be responsible for inspection, maintenance and repair activities.
- All disturbed areas will be treated with 4" of topsoil and seed.
- Remove siltation controls upon completion of permanent vegetation over disturbed areas.
- A preconstruction meeting shall take place prior to construction and the contractor shall present a plan for vehicle entrance/exiting and vehicle washout areas. At the time of this report, there is no contractor involved in the

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project. It is the opinion of DeVellis Zrein, Inc. that it is in the best interest of the Town of Wellesley not to dictate the means and methods of the specific site setup for the contractor, but rather require the contractor to provide this information prior to construction.

# Stormwater Management System Owner

This site is owned by the Town of Wellesley and the town will continue to perform site maintenance and operations.

# Estimated Operations Budget

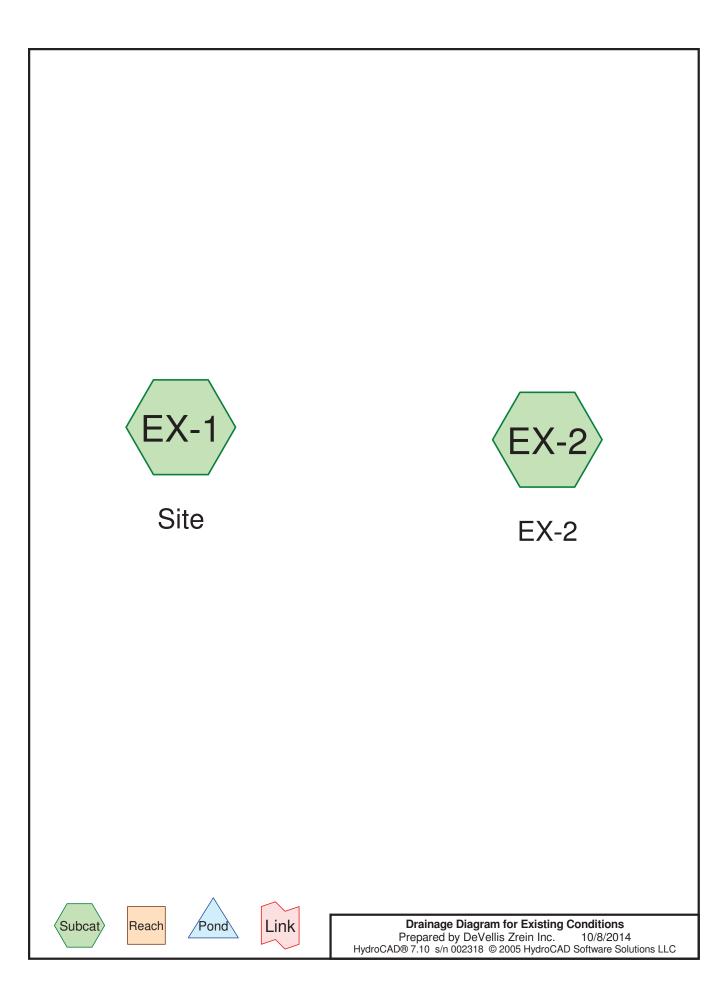
It is not anticipated that the stormwater maintenance required would be considered extraordinary. A yearly estimated operations budget for consideration to carry out the Operations and Maintenance Plan requirements is as follows:

- \$0: Inspect the perimeter landscaping annually, in the spring, for erosion of side slopes, embankments, and accumulated sediment. Necessary sediment removal, earth repair and/or reseeding shall be performed immediately upon identification.
- \$1000: Clean all catch basins and water quality structures annually to remove accumulated sand, sediment, and floatable products. Dispose and transport accumulated sediment off-site in accordance with applicable local, state and federal guidelines and regulations. This should be incorporated into the DPW routine maintenance protocol.
- \$400: Remove accumulated leaves and debris from catch basins and outlet openings.
- \$100: Routinely pick up and remove litter from the parking areas, islands and perimeter landscape area, in addition to pavement sweeping.
- \$500: Replant/replenish the rain gardens with specific plantings. Trim and prune as needed.

# Appendix A – Hydrologic Calculations and Drain Pipe Calculations

- Hydrologic Model Existing Conditions Stormwater Runoff Area Calculations Existing Conditions Calculations 2-Year Storm 10-Year Storm 100-Year Storm
- Hydrologic Model Proposed Conditions Stormwater Runoff Area Calculations Proposed Conditions Calculations 2-Year Storm 10-Year Storm 25-Year Storm 100-Year Storm

Hydrologic Model - Existing Conditions



Tolles-Parsons Senior Center Type III 24-hr 2-year Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Site Runoff Area=29,893 sf Runoff Depth=0.41"

Flow Length=262' Tc=10.2 min CN=60 Runoff=0.16 cfs 0.023 af

Subcatchment EX-2: EX-2 Runoff Area=12,043 sf Runoff Depth=1.15"

Tc=6.0 min CN=76 Runoff=0.35 cfs 0.027 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.050 af Average Runoff Depth = 0.62"

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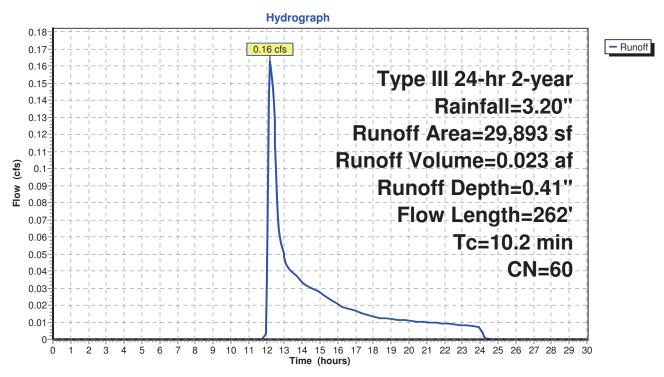
### **Subcatchment EX-1: Site**

Runoff = 0.16 cfs @ 12.22 hrs, Volume= 0.023 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 2-year Rainfall=3.20"

_	Α	rea (sf)	CN I	Description					
		2,953	98 I	Paved parking & roofs					
		20,667	49 5	50-75% Grass cover, Fair, HSG A					
_	6,273 76 Gravel roads, HSG A								
	29,893 60 Weighted Average								
	Тс	Length	Slope	Velocity	Capacity	Description			
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
	8.6	60	0.0100	0.1		Sheet Flow, T1			
						Grass: Short n= 0.150 P2= 3.20"			
	1.6	202	0.0180	2.2		Shallow Concentrated Flow, T2			
						Unpaved Kv= 16.1 fps			
	10.2	262	Total						

### **Subcatchment EX-1: Site**



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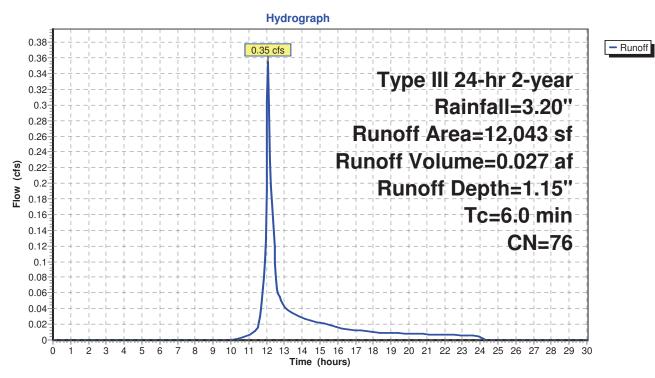
### Subcatchment EX-2: EX-2

Runoff = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 2-year Rainfall=3.20"

_	Д	rea (sf)	CN	Description						
		6,548	98	Paved parking & roofs						
_		5,495	49	50-75% Grass cover, Fair, HSG A						
		12,043 76 Weighted Average								
_	Tc (min)	Length (feet)	Slop (ft/f	•	Capacity (cfs)	Description				
	6.0	•		•	•	Direct Entry				

### Subcatchment EX-2: EX-2



Tolles-Parsons Senior Center Type III 24-hr 10-year Rainfall=4.80"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Site Runoff Area=29,893 sf Runoff Depth=1.19"

Flow Length=262' Tc=10.2 min CN=60 Runoff=0.72 cfs 0.068 af

Subcatchment EX-2: EX-2 Runoff Area=12,043 sf Runoff Depth=2.37"

Tc=6.0 min CN=76 Runoff=0.75 cfs 0.055 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.122 af Average Runoff Depth = 1.53"

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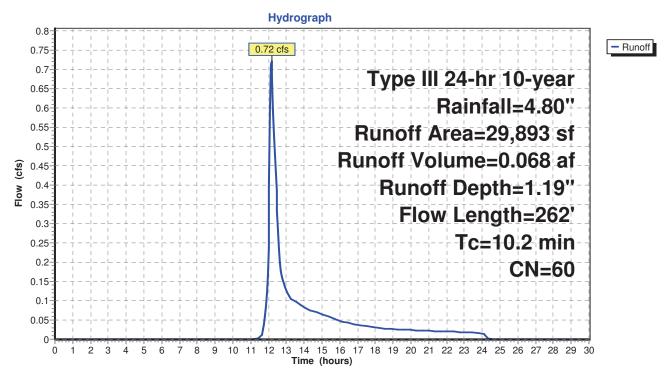
### **Subcatchment EX-1: Site**

Runoff = 0.72 cfs @ 12.16 hrs, Volume= 0.068 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 10-year Rainfall=4.80"

_	Α	rea (sf)	CN I	Description					
		2,953	98 I	Paved parking & roofs					
		20,667	49 5	50-75% Grass cover, Fair, HSG A					
_	6,273 76 Gravel roads, HSG A								
	29,893 60 Weighted Average								
	Тс	Length	Slope	Velocity	Capacity	Description			
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
	8.6	60	0.0100	0.1		Sheet Flow, T1			
						Grass: Short n= 0.150 P2= 3.20"			
	1.6	202	0.0180	2.2		Shallow Concentrated Flow, T2			
						Unpaved Kv= 16.1 fps			
	10.2	262	Total						

## **Subcatchment EX-1: Site**



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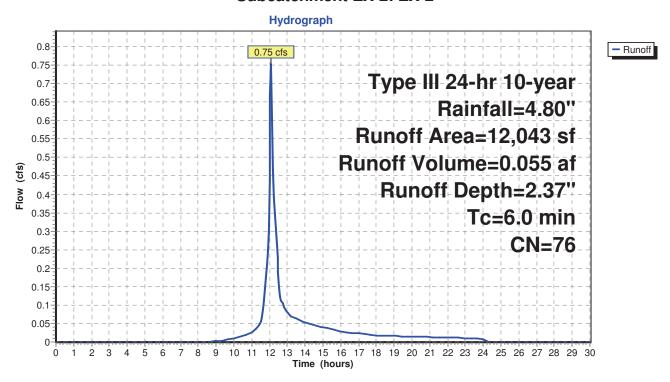
### Subcatchment EX-2: EX-2

Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 10-year Rainfall=4.80"

_	Д	rea (sf)	CN	Description						
		6,548	98	Paved parking & roofs						
_		5,495	495 49 50-75% Grass cover, Fair, HSG A							
		12,043 76 Weighted Average								
_	Tc (min)	Length (feet)	Slop (ft/f	,	Capacity (cfs)	Description				
	6.0					Direct Entry.				

### Subcatchment EX-2: EX-2



Tolles-Parsons Senior Center Type III 24-hr 25-Year Rainfall=5.35"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Site Runoff Area=29,893 sf Runoff Depth=1.51"

Flow Length=262' Tc=10.2 min CN=60 Runoff=0.95 cfs 0.086 af

Subcatchment EX-2: EX-2 Runoff Area=12,043 sf Runoff Depth=2.83"

Tc=6.0 min CN=76 Runoff=0.90 cfs 0.065 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.151 af Average Runoff Depth = 1.89"

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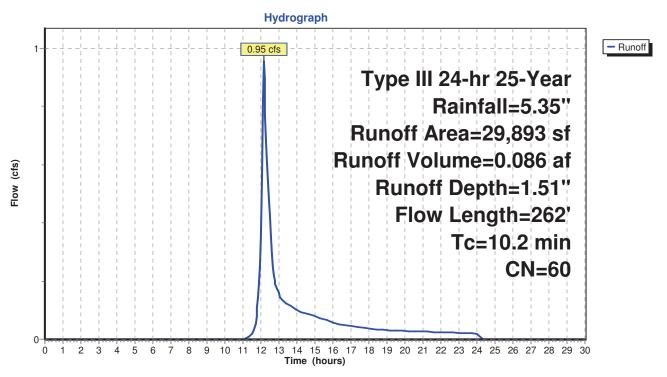
### **Subcatchment EX-1: Site**

Runoff = 0.95 cfs @ 12.16 hrs, Volume= 0.086 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=5.35"

_	Α	rea (sf)	CN [	Description					
		2,953	98 F	8 Paved parking & roofs					
		20,667	49 5	50-75% Grass cover, Fair, HSG A					
_	6,273 76 Gravel roads, HSG A								
	29,893 60 Weighted Average								
	Tc	Length	Slope	•	Capacity	Description			
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
	8.6	60	0.0100	0.1		Sheet Flow, T1			
						Grass: Short n= 0.150 P2= 3.20"			
	1.6	202	0.0180	2.2		Shallow Concentrated Flow, T2			
						Unpaved Kv= 16.1 fps			
	10.2	262	Total						

## **Subcatchment EX-1: Site**



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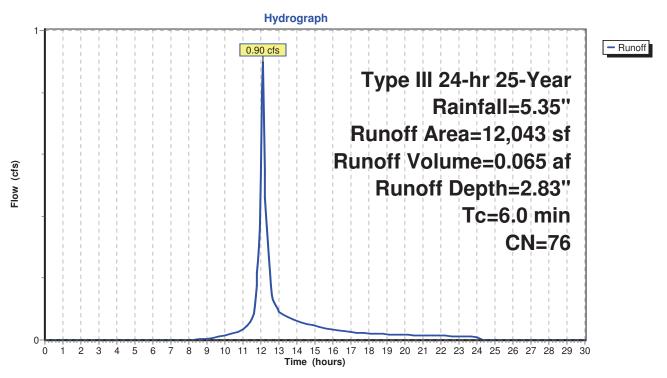
### Subcatchment EX-2: EX-2

Runoff = 0.90 cfs @ 12.09 hrs, Volume= 0.065 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=5.35"

A	rea (sf)	CN	Description					
	6,548	98	Paved parking & roofs					
	5,495	49	1					
	12,043 76 Weighted Average							
Tc	Length	Slope	Velocity	Capacity	Description			
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
6.0					Direct Entry,			

### Subcatchment EX-2: EX-2



# **Existing Conditions**

Tolles-Parsons Senior Center Type III 24-hr 100-year Rainfall=6.80"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Site Runoff Area=29,893 sf Runoff Depth=2.46"

Flow Length=262' Tc=10.2 min CN=60 Runoff=1.64 cfs 0.141 af

Subcatchment EX-2: EX-2 Runoff Area=12,043 sf Runoff Depth=4.08"

Tc=6.0 min CN=76 Runoff=1.29 cfs 0.094 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.235 af Average Runoff Depth = 2.93"

## **Existing Conditions**

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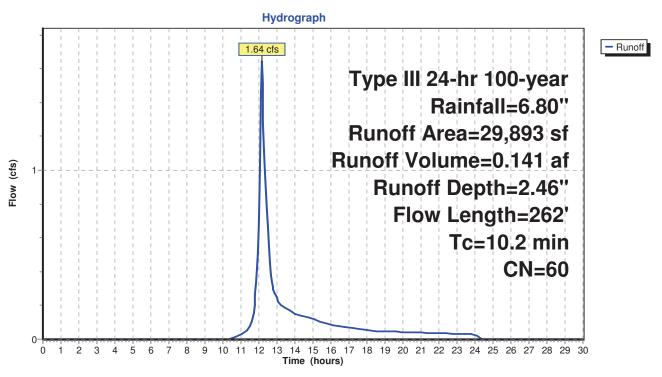
#### **Subcatchment EX-1: Site**

Runoff = 1.64 cfs @ 12.15 hrs, Volume= 0.141 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 100-year Rainfall=6.80"

	Α	rea (sf)	CN [	Description			
		2,953	98 F	Paved park	ing & roofs		
		20,667	49 5	50-75% Gra	ass cover, F	Fair, HSG A	
_		6,273	76 (	Gravel road	ls, HSG A		
		29,893	60 V	Veighted A	verage		
	Tc	Length	Slope	Velocity	Capacity	Description	
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)		
	8.6	60	0.0100	0.1		Sheet Flow, T1	
						Grass: Short n= 0.150 P2= 3.20"	
	1.6	202	0.0180	2.2		Shallow Concentrated Flow, T2	
						Unpaved Kv= 16.1 fps	
	10.2	262	Total				

## Subcatchment EX-1: Site



## **Existing Conditions**

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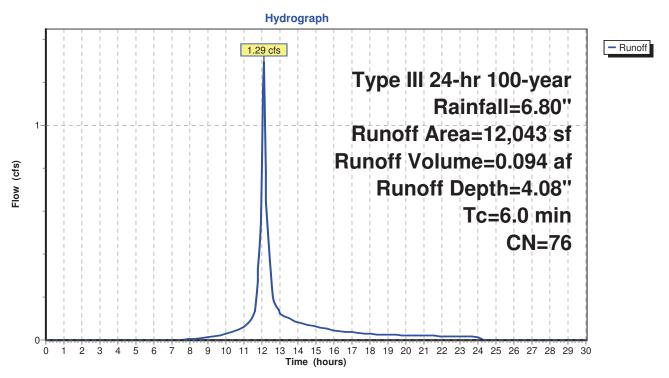
#### Subcatchment EX-2: EX-2

Runoff = 1.29 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 4.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs Type III 24-hr 100-year Rainfall=6.80"

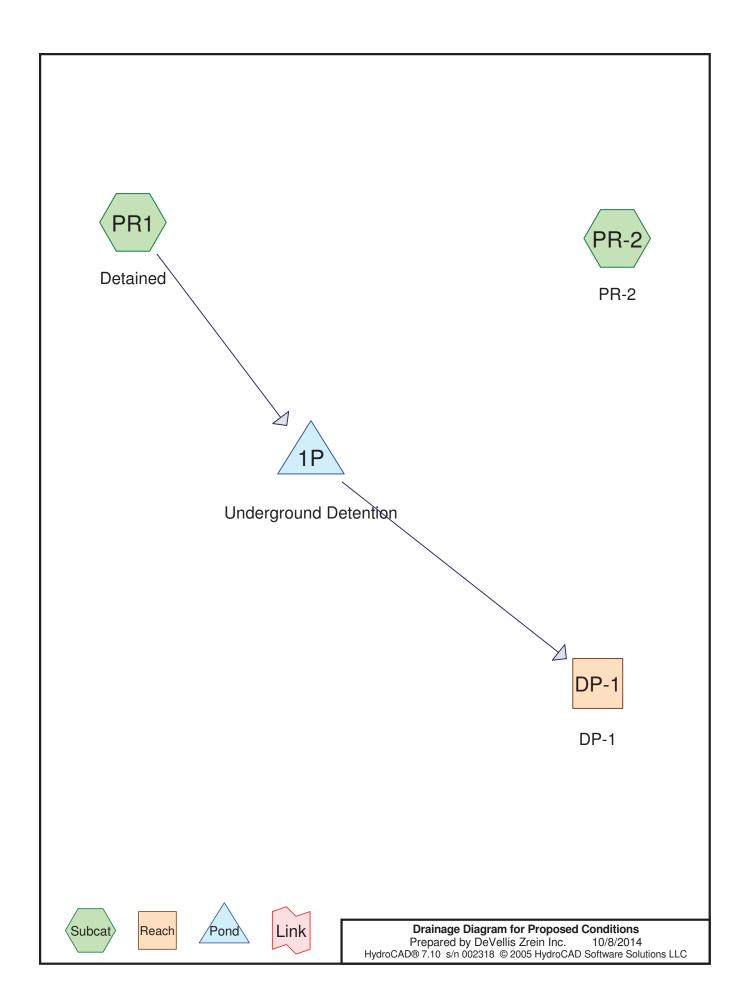
Ar	ea (sf)	CN	CN Description				
	6,548	48 98 Paved parking & roofs					
	5,495 49 50-75% Grass cover, Fair, HSG A						
	12,043	76	Weighted A	verage			
Tc (min)	Length (feet)	Slop (ft/f	•	Capacity (cfs)			
6.0	(.301)	(101	(12/000)	(0.0)	Direct Entry		

## Subcatchment EX-2: EX-2



Drainage Report

Hydrologic Model - Proposed Conditions



Tolles-Parsons Senior Center Type III 24-hr 2-year Rainfall=3.20"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-2: PR-2 Runoff Area=1,295 sf Runoff Depth=0.00"

Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment PR1: Detained Runoff Area=40,641 sf Runoff Depth=2.08"

Tc=6.0 min CN=89 Runoff=2.21 cfs 0.162 af

**Reach DP-1: DP-1** Inflow=0.00 cfs 0.000 af

Outflow=0.00 cfs 0.000 af

Pond 1P: Underground Detention Peak Elev=141.85' Storage=1,766 cf Inflow=2.21 cfs 0.162 af

Discarded=0.46 cfs 0.162 af Primary=0.00 cfs 0.000 af Outflow=0.46 cfs 0.162 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.162 af Average Runoff Depth = 2.02"

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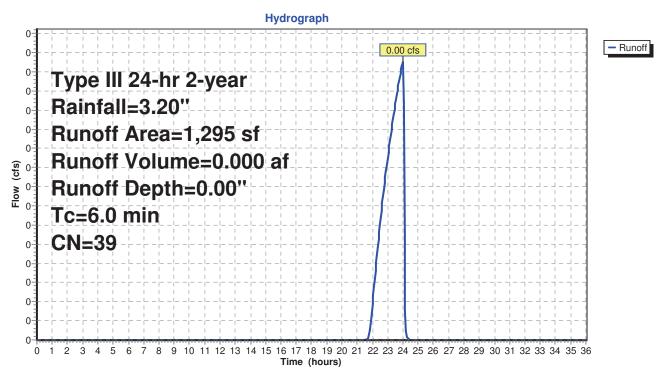
#### Subcatchment PR-2: PR-2

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 2-year Rainfall=3.20"

Ar	ea (sf)	CN	Description					
	1,295	39	39 >75% Grass cover, Good, HSG A					
Tc (min)	Length (feet)	Slope (ft/ft)	•	Capacity (cfs)	Description			
6.0			·	·	Direct Entry,			

#### Subcatchment PR-2: PR-2



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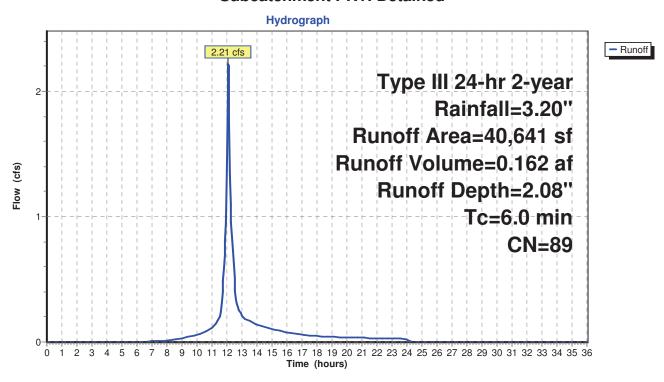
#### **Subcatchment PR1: Detained**

Runoff = 2.21 cfs @ 12.09 hrs, Volume= 0.162 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 2-year Rainfall=3.20"

/	Area (sf)	CN	N Description				
	34,754	98	Paved park	ing & roofs	3		
	5,887	39	>75% Grass	ood, HSG A			
	40,641	89	Weighted A	verage			
To (min)	- 3-	Slop (ft/f	•	Capacity (cfs)	Description		
6.0	,	(10)	(1000)	(0.0)	Direct Entry.		

#### **Subcatchment PR1: Detained**



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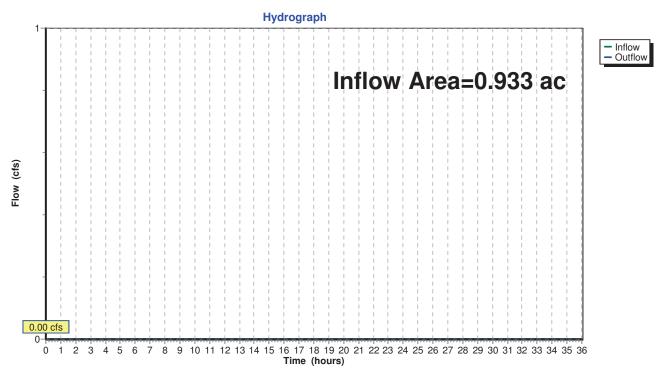
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## Reach DP-1: DP-1

Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

#### Reach DP-1: DP-1



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## **Pond 1P: Underground Detention**

Inflow Area = 0.933 ac, Inflow Depth = 2.08" for 2-year event

Inflow = 2.21 cfs @ 12.09 hrs, Volume= 0.162 af

Outflow = 0.46 cfs @ 11.80 hrs, Volume= 0.162 af, Atten= 79%, Lag= 0.0 min

Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Peak Elev= 141.85' @ 12.52 hrs Surf.Area= 2,400 sf Storage= 1,766 cf Plug-Flow detention time= 22.2 min calculated for 0.162 af (100% of inflow) Center-of-Mass det. time= 22.2 min (833.3 - 811.1)

Volume	Invert	Avail.Storage	Storage Description
#1	140.50'	2,963 cf	Custom Stage Data (Prismatic) Listed below (Recalc) x 8
			10,800 cf Overall - 3,393 cf Embedded = 7,407 cf x 40.0% Voids
#2	141.00'	3,393 cf	36.0"D x 60.00'L Horizontal Cylinder x 8 Inside #1
		6,356 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.50	300	0	0
141.00	300	150	150
142.00	300	300	450
143.00	300	300	750
144.00	300	300	1,050
145.00	300	300	1,350

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	143.00'	<b>5.0" Vert. Orifice/Grate</b> C= 0.600
#3	Discarded	0.00'	8.270 in/hr Exfiltration over Surface area

**Discarded OutFlow** Max=0.46 cfs @ 11.80 hrs HW=140.56' (Free Discharge) **3=Exfiltration** (Exfiltration Controls 0.46 cfs)

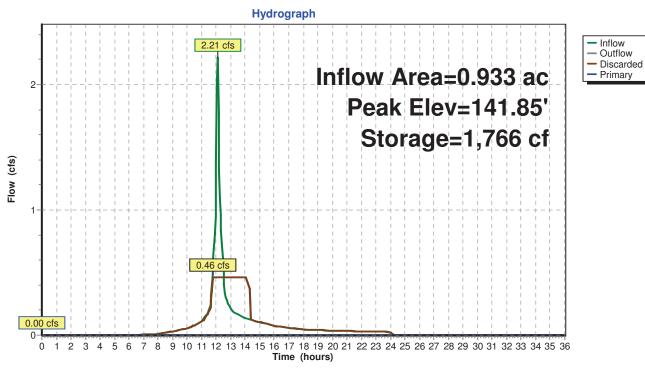
**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=140.50' (Free Discharge)

1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Controls 0.00 cfs)

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# **Pond 1P: Underground Detention**



Tolles-Parsons Senior Center Type III 24-hr 10-year Rainfall=4.80"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-2: PR-2 Runoff Area=1,295 sf Runoff Depth=0.16"

Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment PR1: Detained Runoff Area=40,641 sf Runoff Depth=3.58"

Tc=6.0 min CN=89 Runoff=3.73 cfs 0.278 af

Reach DP-1: DP-1

Outflow=0.34 cfs 0.030 af

Pond 1P: Underground Detention Peak Elev=142.83' Storage=3,540 cf Inflow=3.73 cfs 0.278 af

Discarded=0.46 cfs 0.249 af Primary=0.34 cfs 0.030 af Outflow=0.80 cfs 0.278 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.279 af Average Runoff Depth = 3.48"

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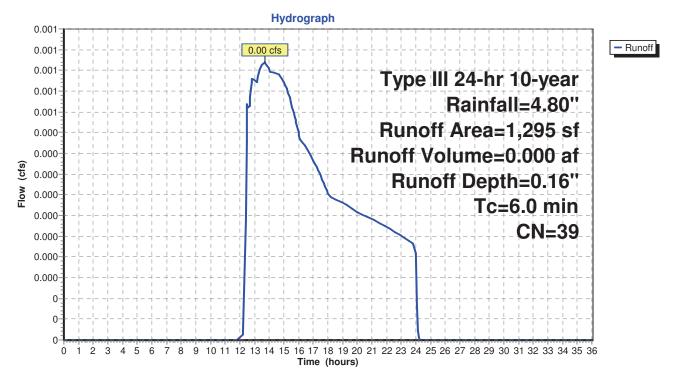
#### Subcatchment PR-2: PR-2

Runoff = 0.00 cfs @ 13.67 hrs, Volume= 0.000 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 10-year Rainfall=4.80"

Ar	ea (sf)	CN	Description					
	1,295	39	39 >75% Grass cover, Good, HSG A					
Tc (min)	Length (feet)	Slope (ft/ft)	•	Capacity (cfs)	Description			
6.0			·	·	Direct Entry,			

#### Subcatchment PR-2: PR-2



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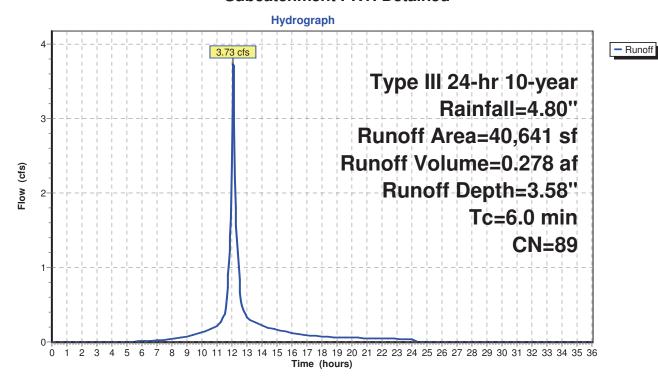
#### **Subcatchment PR1: Detained**

Runoff = 3.73 cfs @ 12.09 hrs, Volume= 0.278 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN I	Description			
34,754	98 I	Paved parki	ng & roofs	3	
5,887	5,887 39 >75% Grass cover, Good, HSG A				
40,641	89 \	Weighted A	verage		
Tc Length (min) (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)		
6.0			•	Direct Entry	

#### **Subcatchment PR1: Detained**



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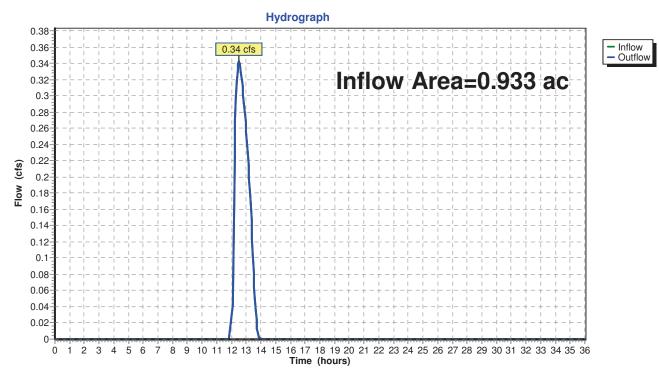
#### Reach DP-1: DP-1

Inflow Area = 0.933 ac, Inflow Depth = 0.38" for 10-year event Inflow = 0.34 cfs @ 12.51 hrs, Volume= 0.030 af

Outflow = 0.34 cfs @ 12.51 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

#### Reach DP-1: DP-1



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## **Pond 1P: Underground Detention**

Inflow Area = 0.933 ac, Inflow Depth = 3.58" for 10-year event 3.73 cfs @ 12.09 hrs, Volume= 0.278 af 0.80 cfs @ 12.51 hrs, Volume= 0.278 af, Atten= 78%, Lag= 25.2 min 0.34 cfs @ 11.65 hrs, Volume= 0.34 cfs @ 12.51 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Peak Elev= 142.83' @ 12.51 hrs Surf.Area= 2,400 sf Storage= 3,540 cf Plug-Flow detention time= 37.7 min calculated for 0.278 af (100% of inflow) Center-of-Mass det. time= 37.7 min (833.5 - 795.8)

Volume	Invert	Avail.Storage	Storage Description
#1	140.50'	2,963 cf	Custom Stage Data (Prismatic) Listed below (Recalc) x 8
			10,800 cf Overall - 3,393 cf Embedded = 7,407 cf x 40.0% Voids
#2	141.00'	3,393 cf	36.0"D x 60.00'L Horizontal Cylinder x 8 Inside #1
•		6,356 cf	Total Available Storage

Elevation	Surf.Area	Inc.Store	Cum.Store
(feet)	(sq-ft)	(cubic-feet)	(cubic-feet)
140.50	300	0	0
141.00	300	150	150
142.00	300	300	450
143.00	300	300	750
144.00	300	300	1,050
145.00	300	300	1,350

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	143.00'	<b>5.0" Vert. Orifice/Grate</b> C= 0.600
#3	Discarded	0.00'	8.270 in/hr Exfiltration over Surface area

**Discarded OutFlow** Max=0.46 cfs @ 11.65 hrs HW=140.56' (Free Discharge) **3=Exfiltration** (Exfiltration Controls 0.46 cfs)

**Primary OutFlow** Max=0.34 cfs @ 12.51 hrs HW=142.83' (Free Discharge)

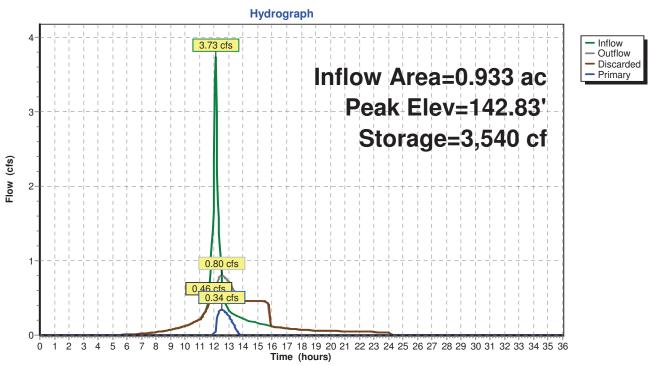
1=Orifice/Grate (Orifice Controls 0.34 cfs @ 3.9 fps)

-2=Orifice/Grate (Controls 0.00 cfs)

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# **Pond 1P: Underground Detention**



Tolles-Parsons Senior Center Type III 24-hr 25-Year Rainfall=5.35"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-2: PR-2 Runoff Area=1,295 sf Runoff Depth=0.28"

Tc=6.0 min CN=39 Runoff=0.00 cfs 0.001 af

Subcatchment PR1: Detained Runoff Area=40,641 sf Runoff Depth=4.11"

Tc=6.0 min CN=89 Runoff=4.25 cfs 0.319 af

Reach DP-1: DP-1

Outflow=0.49 cfs 0.046 af

Pond 1P: Underground Detention Peak Elev=143.17' Storage=4,139 cf Inflow=4.25 cfs 0.319 af

Discarded=0.46 cfs 0.273 af Primary=0.49 cfs 0.046 af Outflow=0.95 cfs 0.319 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.320 af Average Runoff Depth = 3.99"

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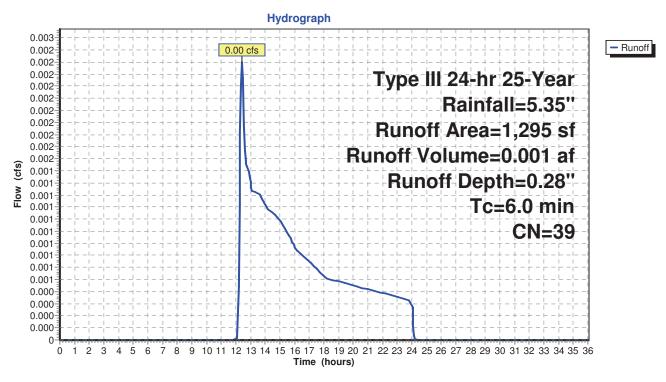
#### Subcatchment PR-2: PR-2

Runoff = 0.00 cfs @ 12.42 hrs, Volume= 0.001 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=5.35"

Aı	rea (sf)	CN	Description			
	1,295	39	>75% Gras	s cover, Go	ood, HSG A	
Tc (min)	Length (feet)	Slope (ft/ft	•	Capacity (cfs)	Description	
6.0		•			Direct Entry,	

#### Subcatchment PR-2: PR-2



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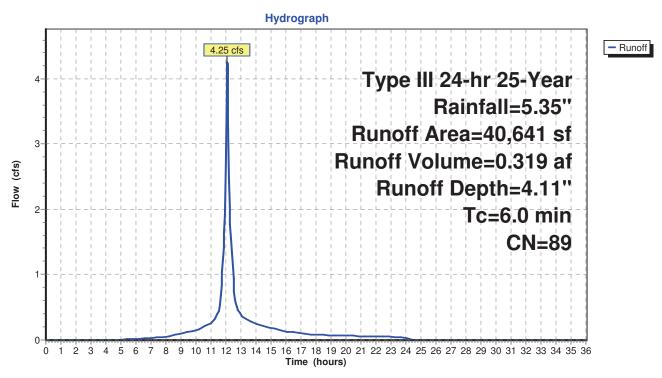
#### **Subcatchment PR1: Detained**

Runoff = 4.25 cfs @ 12.09 hrs, Volume= 0.319 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=5.35"

	Α	rea (sf)	CN	Description		
		34,754	98	Paved parki	ing & roofs	
_		5,887	39	>75% Grass	s cover, Go	ood, HSG A
		40,641	89	Weighted A	verage	
	Tc (min)	Length (feet)	Slop (ft/f	,	Capacity (cfs)	Description
	6.0		•			Direct Entry

## **Subcatchment PR1: Detained**



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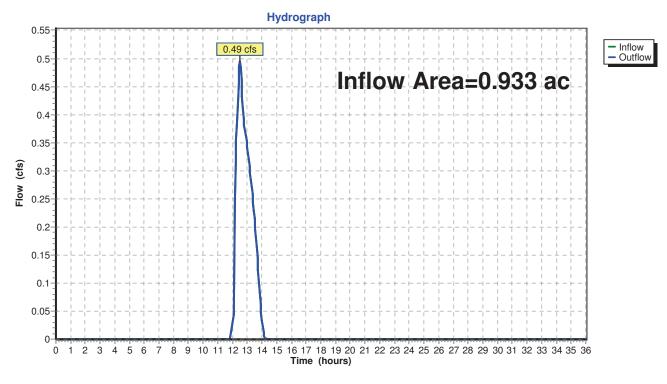
#### Reach DP-1: DP-1

Inflow Area = 0.933 ac, Inflow Depth = 0.59" for 25-Year event Inflow = 0.49 cfs @ 12.50 hrs, Volume= 0.046 af

Outflow = 0.49 cfs @ 12.50 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

#### Reach DP-1: DP-1



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## **Pond 1P: Underground Detention**

Inflow Area =	0.933 ac, Inflow Depth = 4.11"	for 25-Year event
Inflow =	4.25 cfs @ 12.09 hrs, Volume=	0.319 af
Outflow =	0.95 cfs @ 12.50 hrs, Volume=	0.319 af, Atten= 78%, Lag= 24.6 min
Discarded =	0.46 cfs @ 11.60 hrs, Volume=	0.273 af
Primary =	0.49 cfs @ 12.50 hrs, Volume=	0.046 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Peak Elev= 143.17' @ 12.50 hrs Surf.Area= 2,400 sf Storage= 4,139 cf Plug-Flow detention time= 40.4 min calculated for 0.319 af (100% of inflow) Center-of-Mass det. time= 40.3 min (832.4 - 792.0)

Volume	Invert	Avail.Storage	Storage Description
#1	140.50'	2,963 cf	Custom Stage Data (Prismatic) Listed below (Recalc) x 8
			10,800 cf Overall - 3,393 cf Embedded = 7,407 cf x 40.0% Voids
#2	141.00'	3,393 cf	36.0"D x 60.00'L Horizontal Cylinder x 8 Inside #1
•		6,356 cf	Total Available Storage

Elevation	Surf.Area	Inc.Store	Cum.Store
(feet)	(sq-ft)	(cubic-feet)	(cubic-feet)
140.50	300	0	0
141.00	300	150	150
142.00	300	300	450
143.00	300	300	750
144.00	300	300	1,050
145.00	300	300	1,350

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	143.00'	<b>5.0" Vert. Orifice/Grate</b> C= 0.600
#3	Discarded	0.00'	8.270 in/hr Exfiltration over Surface area

**Discarded OutFlow** Max=0.46 cfs @ 11.60 hrs HW=140.55' (Free Discharge) **3=Exfiltration** (Exfiltration Controls 0.46 cfs)

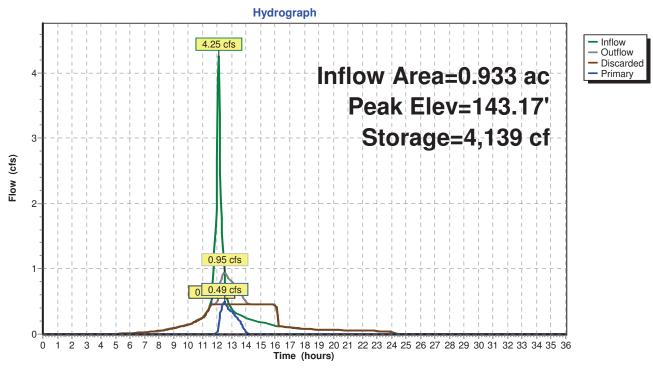
**Primary OutFlow** Max=0.49 cfs @ 12.50 hrs HW=143.17' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.42 cfs @ 4.8 fps)
2=Orifice/Grate (Orifice Controls 0.07 cfs @ 1.4 fps)

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# **Pond 1P: Underground Detention**



Subcatchment PR-2: PR-2

Tolles-Parsons Senior Center Type III 24-hr 100-year Rainfall=6.80"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Runoff Area=1,295 sf Runoff Depth=0.70" Tc=6.0 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment PR1: Detained Runoff Area=40,641 sf Runoff Depth=5.51"

Tc=6.0 min CN=89 Runoff=5.61 cfs 0.429 af

**Reach DP-1: DP-1** Inflow=1.15 cfs 0.101 af

Outflow=1.15 cfs 0.101 af

Pond 1P: Underground Detention Peak Elev=143.99' Storage=5,383 cf Inflow=5.61 cfs 0.429 af

Discarded=0.46 cfs 0.327 af Primary=1.15 cfs 0.101 af Outflow=1.61 cfs 0.429 af

Total Runoff Area = 0.963 ac Runoff Volume = 0.430 af Average Runoff Depth = 5.36"

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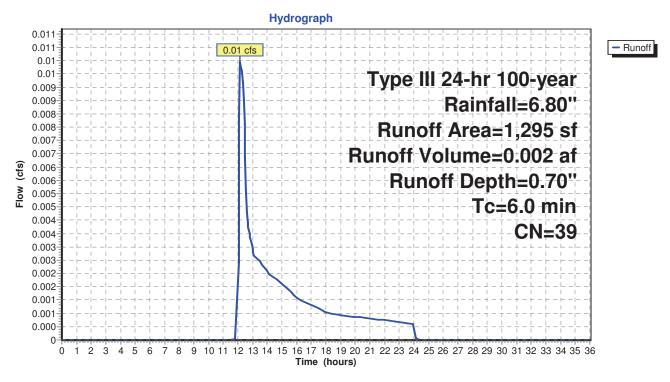
#### **Subcatchment PR-2: PR-2**

Runoff = 0.01 cfs @ 12.15 hrs, Volume= 0.002 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 100-year Rainfall=6.80"

Aı	rea (sf)	CN	Description			
	1,295	39	>75% Gras	s cover, Go	ood, HSG A	
Tc (min)	Length (feet)	Slope (ft/ft	•	Capacity (cfs)	Description	
6.0		•			Direct Entry,	

#### Subcatchment PR-2: PR-2



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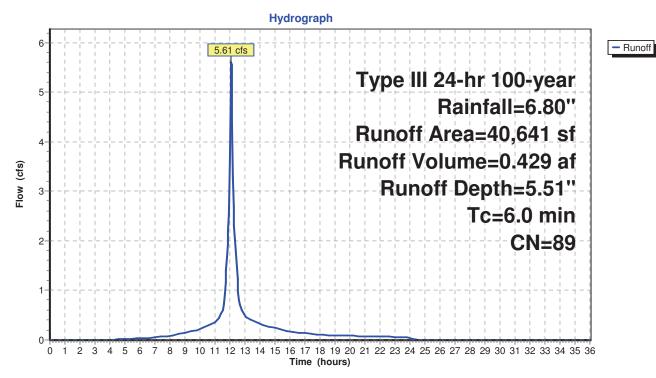
#### **Subcatchment PR1: Detained**

Runoff = 5.61 cfs @ 12.09 hrs, Volume= 0.429 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Type III 24-hr 100-year Rainfall=6.80"

/	Area (sf)	CN	Description		
	34,754	98	Paved park	ing & roofs	3
	5,887	39	>75% Grass	s cover, Go	ood, HSG A
	40,641	89	Weighted A	verage	
To (min)	- 3-	Slop (ft/f	•	Capacity (cfs)	Description
6.0	,	(10)	(1000)	(0.0)	Direct Entry.

## **Subcatchment PR1: Detained**



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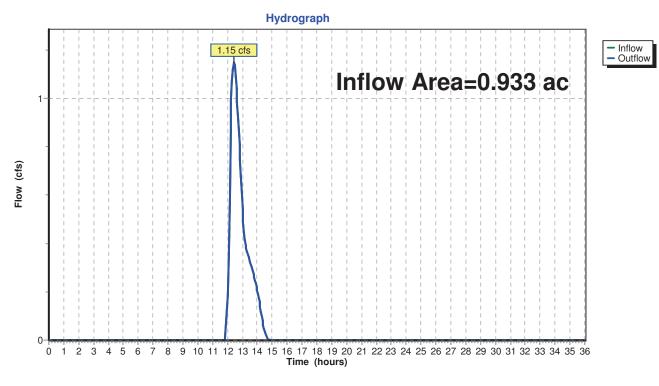
#### Reach DP-1: DP-1

Inflow Area = 0.933 ac, Inflow Depth = 1.30" for 100-year event Inflow = 1.15 cfs @ 12.43 hrs, Volume= 0.101 af

Outflow = 1.15 cfs @ 12.43 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

#### Reach DP-1: DP-1



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#### **Pond 1P: Underground Detention**

Inflow Area = 0.933 ac, Inflow Depth = 5.51" for 100-year event
Inflow = 5.61 cfs @ 12.09 hrs, Volume= 0.429 af
Outflow = 1.61 cfs @ 12.43 hrs, Volume= 0.429 af, Atten= 71%, Lag= 20.4 min
Discarded = 0.46 cfs @ 11.30 hrs, Volume= 0.327 af
Primary = 1.15 cfs @ 12.43 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs Peak Elev= 143.99' @ 12.43 hrs Surf.Area= 2,400 sf Storage= 5,383 cf Plug-Flow detention time= 40.9 min calculated for 0.428 af (100% of inflow) Center-of-Mass det. time= 40.8 min (824.9 - 784.1)

Volume	Invert	Avail.Storage	Storage Description
#1	140.50'	2,963 cf	Custom Stage Data (Prismatic) Listed below (Recalc) x 8
			10,800 cf Overall - 3,393 cf Embedded = 7,407 cf x 40.0% Voids
#2	141.00'	3,393 cf	36.0"D x 60.00'L Horizontal Cylinder x 8 Inside #1
•		6,356 cf	Total Available Storage

Elevation	Surf.Area	Inc.Store	Cum.Store
(feet)	(sq-ft)	(cubic-feet)	(cubic-feet)
140.50	300	0	0
141.00	300	150	150
142.00	300	300	450
143.00	300	300	750
144.00	300	300	1,050
145.00	300	300	1,350

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	143.00'	<b>5.0" Vert. Orifice/Grate</b> C= 0.600
#3	Discarded	0.00'	8.270 in/hr Exfiltration over Surface area

**Discarded OutFlow** Max=0.46 cfs @ 11.30 hrs HW=140.55' (Free Discharge) **3=Exfiltration** (Exfiltration Controls 0.46 cfs)

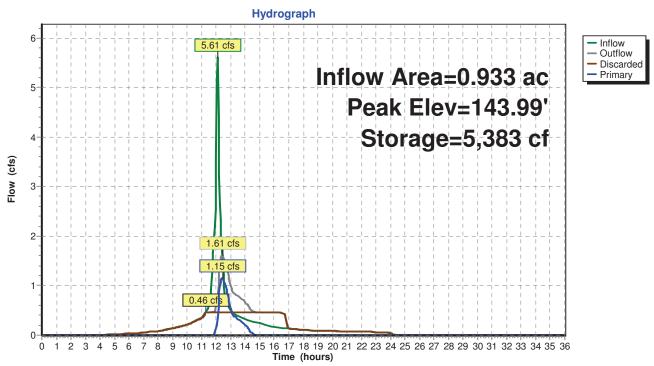
**Primary OutFlow** Max=1.14 cfs @ 12.43 hrs HW=143.98' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.57 cfs @ 6.5 fps)
2=Orifice/Grate (Orifice Controls 0.58 cfs @ 4.2 fps)

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# **Pond 1P: Underground Detention**



Drainage Report

# Appendix B – Water Quality & TSS Calculations

The proposed design exceeds the Department of Environmental Protection requirements for Best Management Practices and water quality.

- TSS Removal Calculations
- Infiltration Volume Calculations

Drainage Report

Total Suspended Solids (TSS) Calculations

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu

2. Select BMP from Drop Down Menu 3. After BMP is selected, TSS Removal and other Columns are automatically completed.

								s to			
	ь. Ц	Remaining Load (D-E)	0.95	0.71	0.14	0.14	0.14	Separate Form Needs to			
	,							Separa			
	ш,	Amount Removed (C*D)	0.05	0.24	0.57	0.00	0.00				
ED RUN (IN WINTER)		Starting TSS Load*	1.00	0.95	0.71	0.14	0.14				
Location: RAIN GARDEN WATERSHED RUN (IN WINTER)	0	TSS Removal Rate <sup>1</sup>	0.05	0.25	0.80	0.00	0.00				
Location:	В	BMP <sup>1</sup>	Street Sweeping - 5%	Deep Sump and Hooded Catch Basin	Subsurface Infiltration Structure						
	TSS Removal Calculation Worksheet										
				-	_						

Total TSS Removal =

be Completed for Each Outlet or BMP Train

%98

Project: Tolles-Parsons Center Wellesley Prepared By: DeVellis Zrein, Inc.

Date: october 9 2014

\*Equals remaining load from previous BMP (E) which enters the BMP Mass. Dept. of Environmental Protection

must be used if Proprietary BMP Proposed 1. From MassDEP Stormwater Handbook Vol. 1 Non-automated TSS Calculation Sheet

Drainage Report

Infiltration Volume Calculations

## Site Planning Civil Engineering Landscape Architecture Po Box 307 Foxborough, MA 508.393.8583 phone develliszrein.com

**Computations** Project Tolles-Parson Center Project # 2G1S-183 Location Wellesley Sheet of 1 JJD Calculated by Date 10/7/2014 **TOG** Checked by Date Title Recharge Calculations

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Volume One)

Design

DeVellis Zrein Inc.

Criteria: Based on the Site Hydrologic Soil Group:

> Hydrologic Soil Group Volume to Recharge (x Total Imp. Area)

Α	0.60 inches of runoff
В	0.35 inches of runoff
С	0.25 inches of runoff
D	0.10 inches of runoff

#### Recharge Area Required:

Total Existing Impervious areas = 9,801 square feet Total Proposed Impervious areas = 34,754 square feet Total Increase in Impervious Area = 24,953 square feet

Required recharge Volume =  $24,953 \times 0.60/12 = 1,248$  cubic feet

Recharge Area Provided: The 2-year storm event of 3.2 inches is 100% contained within the infiltration basin

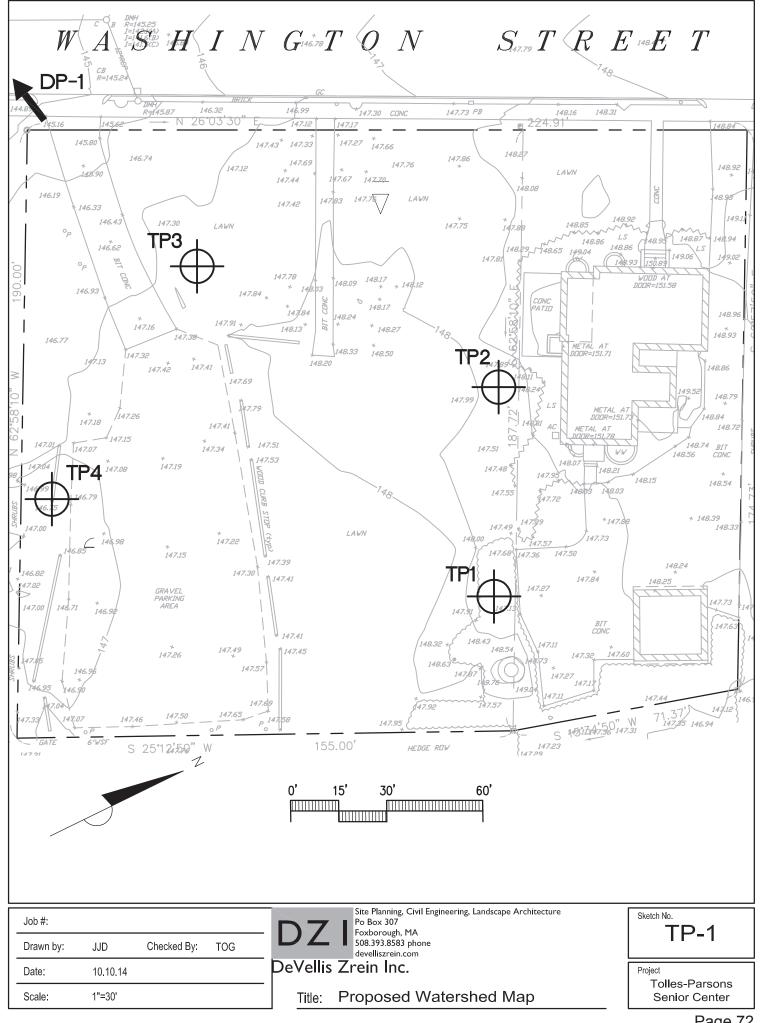
with no discharge off-site. That infiltration volume held and exfiltrated = 0.162 ac ft = 7,056 cubic feet

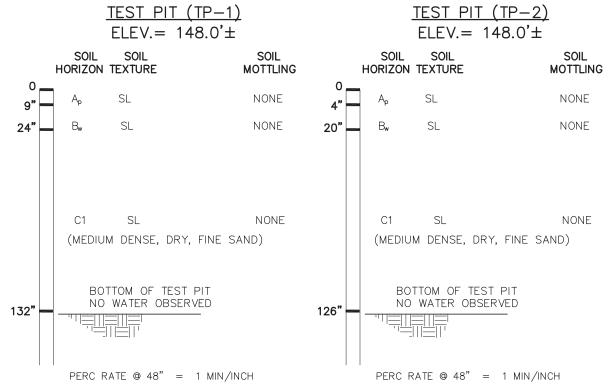
Recharge Required = 1,248 cubic feet Recharge Provided = 7,056 cubic feet

Recharge provided in excess of 5.5 times the requirement

Drainage Report

Appendix C – Geotechnical Report





TEST PIT AND PERCOLATION TEST WERE PERFORMED ON AUGUST 6, 2014
THE TESTING WAS PERFORMED BY JAMES J DEVELLIS, P.E. / REGISTERED SOIL EVALUATOR OF DEVELLIS ZREIN INC. OF FOXBOROUGH, MA

THE TESTING WAS PERFORMED BY JAMES J DEVELLIS, P.E.

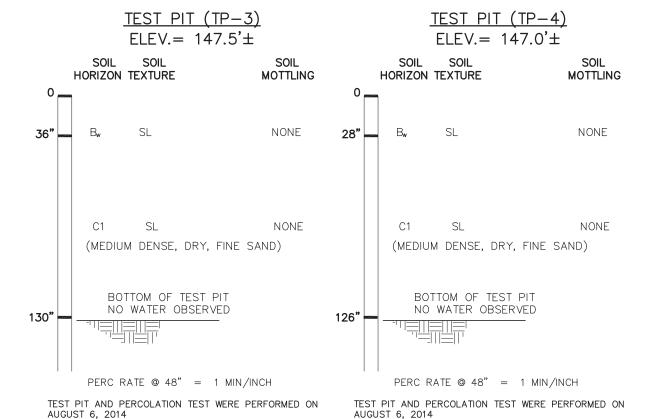
/ REGISTERED SOIL EVALUATOR OF DEVELLIS ZREIN INC.

TEST PIT AND PERCOLATION TEST WERE PERFORMED ON AUGUST 6, 2014
THE TESTING WAS PERFORMED BY JAMES J DEVELLIS, P.E. / REGISTERED SOIL EVALUATOR OF DEVELLIS ZREIN INC. OF FOXBOROUGH, MA

THE TESTING WAS PERFORMED BY JAMES J DEVELLIS, P.E.

/ REGISTERED SOIL EVALUATOR OF DEVELLIS ZREIN INC.

OF FOXBOROUGH, MA



OF FOXBOROUGH, MA

#### **TEST BORING LOG** SHEET 1 Soil Exploration Corp. **Geotechnical Consultants BORING B-1** Geotechnical Drilling Groundwater Monitor Well Site: 496 Washington Avenue 148 Pioneer Drive PROJECT NO. 08-1118 Wellesley, MA Leominster, MA 01453 978 840-0391 DATE: November 17, 2008 Ground Elevation: **GROUNDWATER OBSERVATIONS** Date Started: November 14, 2008 DATE DEPTH **CASING** STABILIZATION Date Finished: November 14, 2008 Driller: GG Soil Engineer/Geologist: Depth Casing Sample Visual Identification Ft. No. Pen/Rec Depth Blows/6" Strata of Soil and / or Rock Sample Medium dense, dry, fine to coarse sand, trace fine to coarse 1 0"-2'0" 1 12-12-10-12 gravel. 3'0" 5 2 5'0"-7'0" 15-9-10-14 Medium dense, dry, fine to coarse sand. 8'0" 10 3 10'0"-12'0" 5-9-8-8 Medium dense, dry, very fine to fine sand. 15 4 15'0"-17'0" 18-10-10-12 20 5 20'0"-22'0" 5-5-5-6 20'0" Medium dense, wet, very fine sand, some inorganic silt. 22'0" End of boring at 22'0". 25 Water encountered at 20'0". 30 35 39 Notes: Hollow Stem Auger Size - 4-1/4" Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, Trace 0 to 10% CASING SAMPLE CORE TYPE 30 M Dense, 30 -50 Dense, 50+ V Dense. Little 10 to 20% ID SIZE (IN) SS .esive: 0-2 V Soft, 2-4 Soft, 4-8 M Stiff Some 20 to 35% HAMMER WGT (LB) 140 lb. 8-15 Stiff, 15-30 V. Stiff, 30 + Hard. 35% to 50% And HAMMER FALL (IN) 30"

#### **TEST BORING LOG** SHEET 2 Soil Exploration Corp. **Geotechnical Consultants BORING B-2** Geotechnical Drilling Site: 496 Washington Avenue Groundwater Monitor Well 148 Pioneer Drive **PROJECT NO. 08-1118** Wellesley, MA Leominster, MA 01453 DATE: November 17, 2008 978 840-0391 GROUNDWATER OBSERVATIONS Ground Elevation: **STABILIZATION** November 14, 2008 DATE DEPTH **CASING** Date Started: November 14, 2008 Date Finished: Driller: Soil Engineer/Geologist: Visual Identification Casing Sample Depth Pen/Rec No. Blows/6" of Soil and / or Rock Sample bl/ft Depth Strata Ft. Medium dense, dry, fine to coarse sand, some fine to medium 0"-2'0" 1 12-14-13-13 gravel, trace silt. 1 3'0" 5 2 5'0"-7'0" 14-14-14-18 Medium dense, dry, fine to coarse sand. 8'0" 10'0"-12'0" 6-6-7-7 10 3 Medium dense, dry, very fine to fine sand. 4 15'0"-17'0" 12-9-10-10 15 20'0" 20 5 20'0"-22'0" 3-3-3-4 6 25'0"-27'0" 3-4-4-4 25 7 Loose to medium dense, wet, very fine sand, some inorganic silt. 30'0"-32'0" 5-5-5-5 30 35 8 35'0"-37'0" 6-10-12-16 (continued to Sheet 3) 39 39'0" Notes: Hollow Stem Auger Size - 4-1/4" SAMPLE CASING CORE TYPE Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, Trace 0 to 10% SS ) -30 M Dense, 30 -50 Dense, 50+ V Dense. Little 10 to 20% ID SIZE (IN) 140 lb. HAMMER WGT (LB) Cohesive: 0-2 V Soft, 2-4 Soft, 4-8 M Stiff Some 20 to 35% 30" 8-15 Stiff, 15-30 V. Stiff, 30 + Hard. 35% to 50% HAMMER FALL (IN)

#### **TEST BORING LOG** SHEET 3 Soil Exploration Corp. **Geotechnical Consultants** BORING B-2 (continued) Geotechnical Drilling Groundwater Monitor Well Site: 496 Washington Avenue 148 Pioneer Drive PROJECT NO. 08-1118 Wellesley, MA Leominster, MA 01453 978 840-0391 DATE: November 17, 2008 Ground Elevation: **GROUNDWATER OBSERVATIONS** Date Started: November 14, 2008 DATE DEPTH **CASING STABILIZATION** Date Finished: November 14, 2008 Driller: Soil Engineer/Geologist: Depth Casing Sample Visual Identification bl/ft Pen/Rec Ft. No. Depth Blows/6" Strata of Soil and / or Rock Sample 40 9 40'0"-42'0" 3-3-6-12 45 10 45'0"-47'0" 4-5-6-6 Medium stiff, wet, inorganic silt, some very fine sand, trace clay. 50 11 50'0"-52'0" 2-2-4-4 54'0" 55 12 55'0"-57'0" 15-18-26-30 Very dense, wet, fine to coarse sand and gravel, trace cobbles. 60 13 60'0"-60'11" 60-100/5" 60'11" End of boring at 60'11". Water encountered at 20'0". 65 70 75 79 Notes: Hollow Stem Auger Size - 4-1/4" Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, Trace 0 to 10% **CASING** SAMPLE CORE TYPE ¹ º - 30 M Dense, 30 - 50 Dense, 50+ V Dense. Little 10 to 20% ID SIZE (IN) SS nesive: 0-2 V Soft, 2-4 Soft, 4-8 M Stiff Some 20 to 35% HAMMER WGT (LB) 140 lb. 8-15 Stiff, 15-30 V. Stiff, 30 + Hard. And 35% to 50% HAMMER FALL (IN) 30"

#### **TEST BORING LOG** SHEET 4 Soil Exploration Corp. **Geotechnical Consultants BORING B-3** Geotechnical Drilling Site: 496 Washington Avenue Groundwater Monitor Well 148 Pioneer Drive PROJECT NO. 08-1118 Wellesley, MA Leominster, MA 01453 978 840-0391 DATE: November 17, 2008 Ground Elevation: **GROUNDWATER OBSERVATIONS** Date Started: November 14, 2008 DATE DEPTH **CASING** STABILIZATION November 14, 2008 Date Finished: Driller: Soil Engineer/Geologist: Depth Casing Sample Visual Identification Pen/Rec Ы/ft No. Ft. Blows/6" Depth Strata of Soil and / or Rock Sample 1 1 0"-2'0" 11-12-10-9 Medium dense, dry, fine to coarse sand, trace fine to medium gravel. 5 2 5'0"-7'0" 12-15-14-14 5'0" 10 3 10'0"-12'0" 5-5-6-7 Medium dense, dry, fine to very fine sand. 15 4 15'0"-17'0" 6-7-7-8 20 5 20'0"-22'0" 5-6-6-6 20'0" Medium dense, wet, very fine sand, some inorganic silt. 22'0" End of boring at 22'0". 25 Water encountered at 20'0". 30 35 39 Notes: Hollow Stem Auger Size - 4-1/4" Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, Trace 0 to 10% **CASING** SAMPLE CORE TYPE ' 9-30 M Dense, 30-50 Dense, 50+ V Dense. Little 10 to 20% ID SIZE (IN) SS iesive: 0-2 V Soft, 2-4 Soft, 4-8 M Stiff Some 20 to 35% HAMMER WGT (LB) 140 lb. 8-15 Stiff, 15-30 V. Stiff, 30 + Hard. And 35% to 50% HAMMER FALL (IN) 30"

#### **TEST BORING LOG** SHEET 5 Soil Exploration Corp. **Geotechnical Consultants BORING B-4** Geotechnical Drilling Groundwater Monitor Well Site: 496 Washington Avenue 148 Pioneer Drive PROJECT NO. 08-1118 Wellesley, MA Leominster, MA 01453 978 840-0391 DATE: November 17, 2008 Ground Elevation: GROUNDWATER OBSERVATIONS Date Started: November 14, 2008 DATE **DEPTH CASING** STABILIZATION November 14, 2008 Date Finished: Driller: Soil Engineer/Geologist: Depth Casing Sample Visual Identification bl∕ft Pen/Rec Ft. No. Blows/6" Depth Strata of Soil and / or Rock Sample 0"-6" Topsoil. 6" 1 5 1 5'0"-7'0" 14-15-17-15 Medium dense, dry, fine to coarse sand. 10 2 10'0"-12'0" 5-7-7-8 11'0" 15 3 15'0"-17'0" 5-7-8-8 Medium dense, dry, fine to very fine sand. 20 4 20'0"-22'0" 5-5-5-5 20'0" Medium dense, wet, very fine sand, some inorganic silt. 25 5 25'0"-27'0" 5-4-5-6 27'0" End of boring at 27'0". 30 Water encountered at 20'0". 35 39 Notes: Hollow Stem Auger Size - 4-1/4" Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, Trace 0 to 10% CASING SAMPLE CORE TYPE 'n -30 M Dense, 30 -50 Dense, 50+ V Dense. Little 10 to 20% ID SIZE (IN) SS nesive: 0-2 V Soft, 2-4 Soft, 4-8 M Stiff 20 to 35% Some HAMMER WGT (LB) 140 lb. 8-15 Stiff, 15-30 V. Stiff, 30 + Hard. 35% to 50% HAMMER FALL (IN) 30"

## B-1

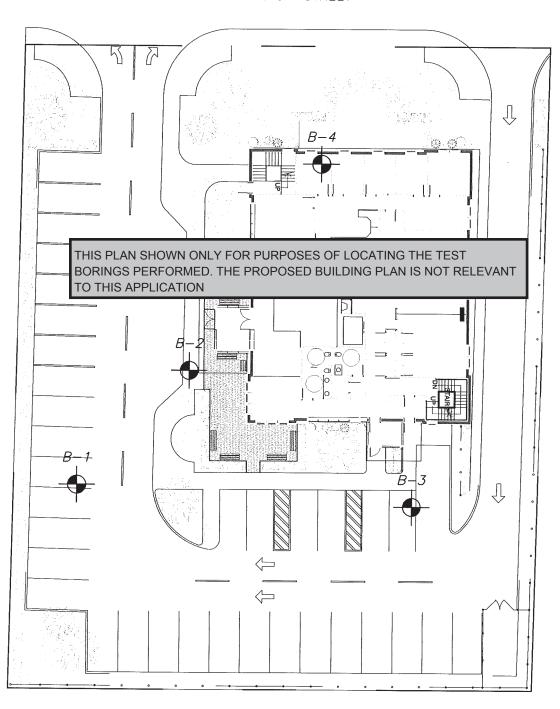
**LEGEND** 



APPROXIMATE LOCATIONS OF BORINGS DONE BY SOIL EXPLORATION, UNDER THE SUPERVISION OF GEOTECHNICAL CONSULTANTS, INC. ON 14 NOVEMBER 2008.



### WASHINGTON STREET



gure 2.

GCI Project No. 2082920

WELLESLEY SENIOR CENTER 496 Washington Street Wellesley, Massachusetts **LOCATION PLAN** 

3 DECEMBER 2008

SCALE: N/A

Geotechnical Consultants, Inc. 201 Boston Post Road West Marlborough, MA 01752 (508)229-0900 FAX (508)229-2279

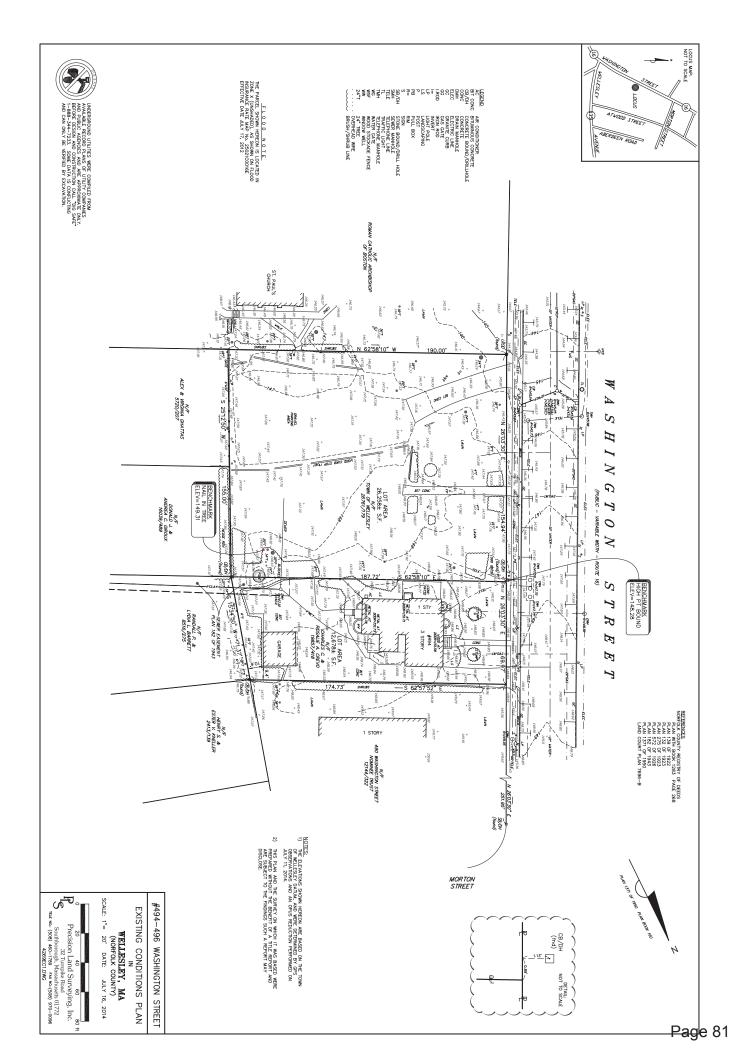


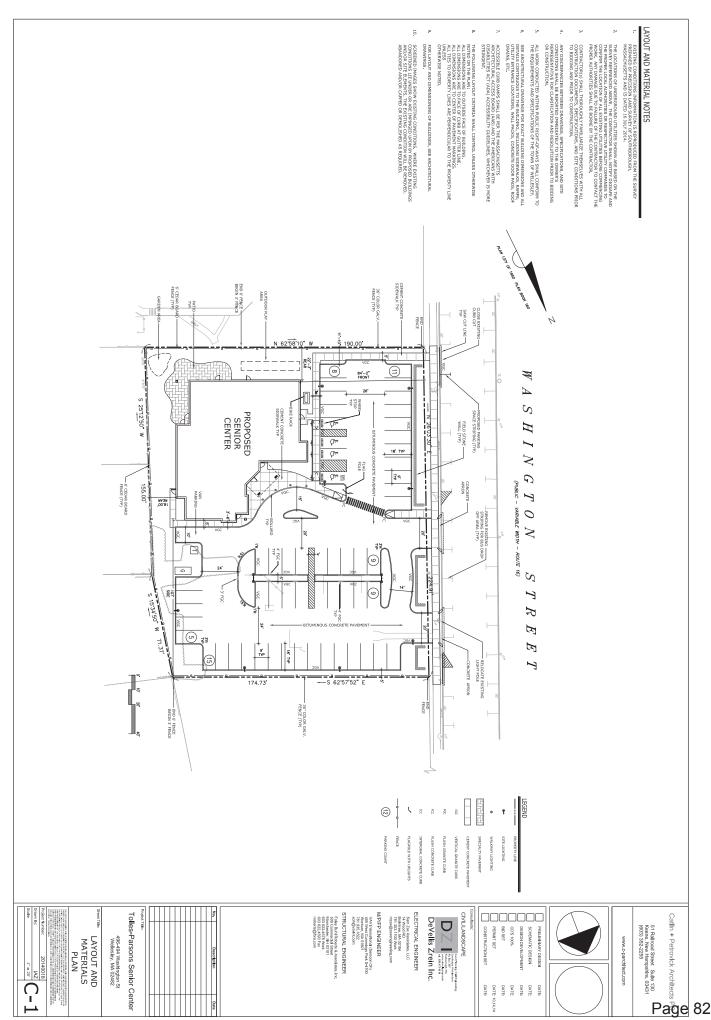
Drainage Report

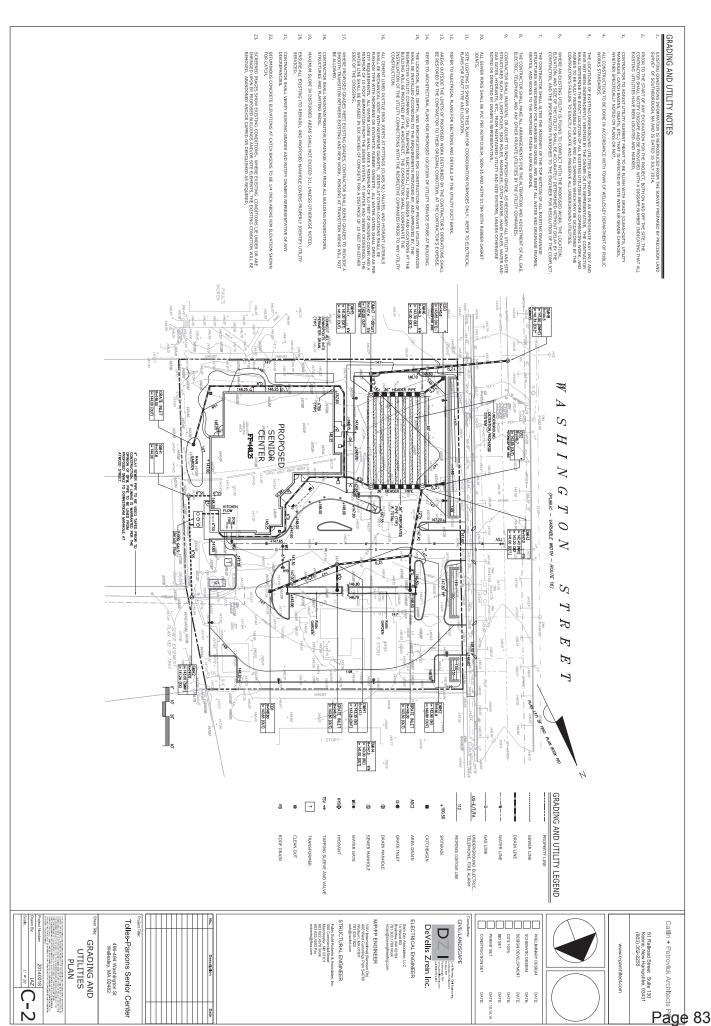
Appendix D – Site Plans

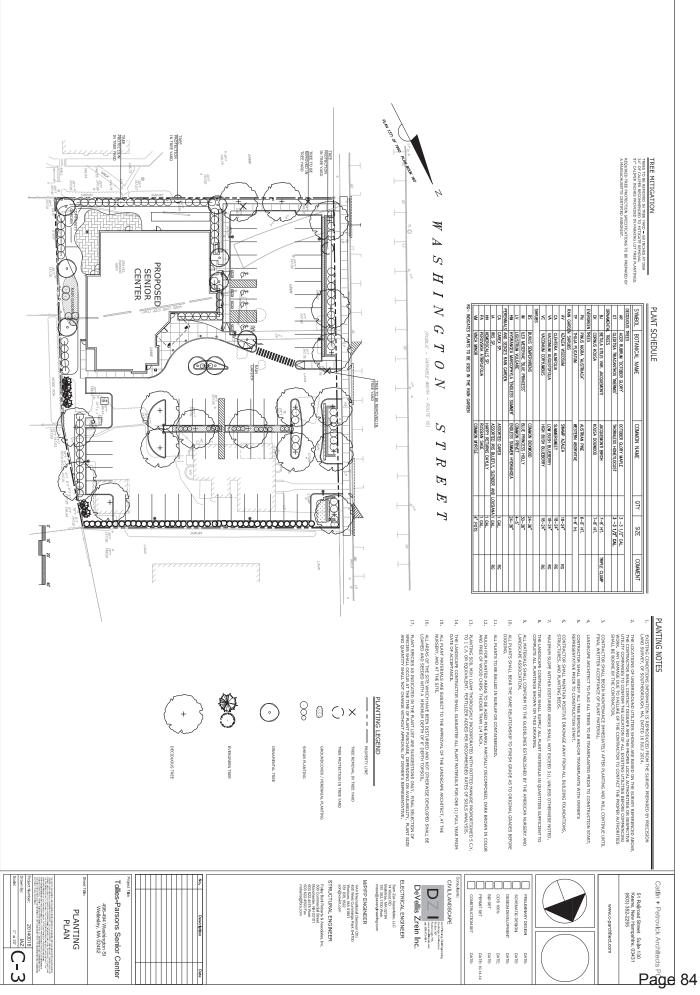
REDUCED AND FULL SIZE PLANS PROVIDED WITHIN THE APPLICATION SUBMISSION PROVIDED BY THE PROJECT ARCHITECT

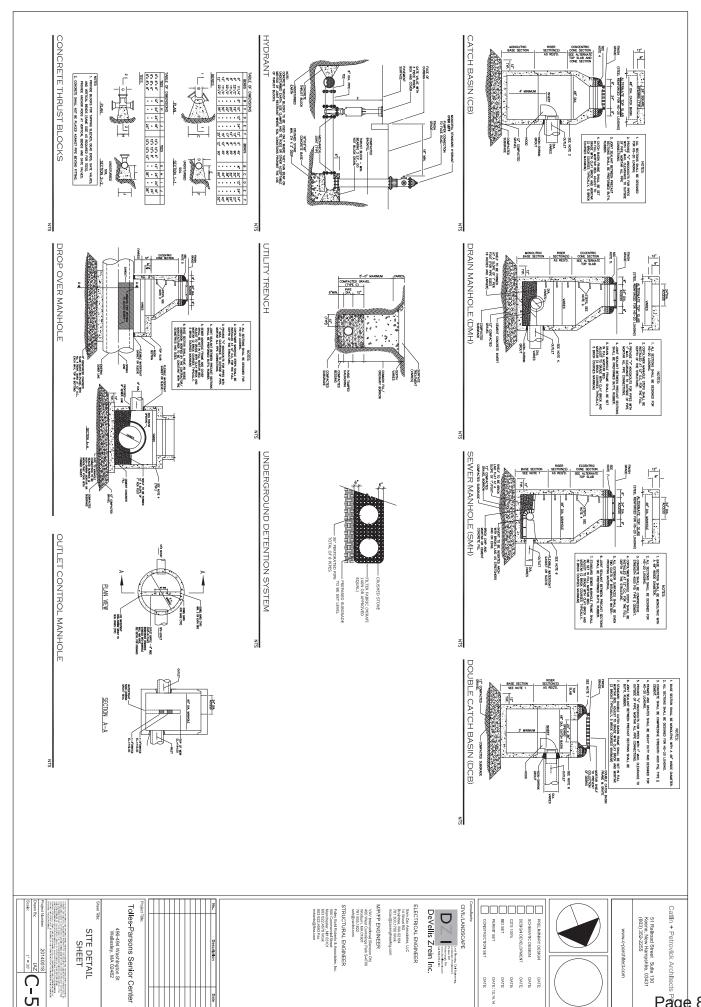
THESE REDUCED COPIES ARE PROVIDED WTIHIN THIS REPORT FOR CONVENIENT REFERENCE PURPOSES

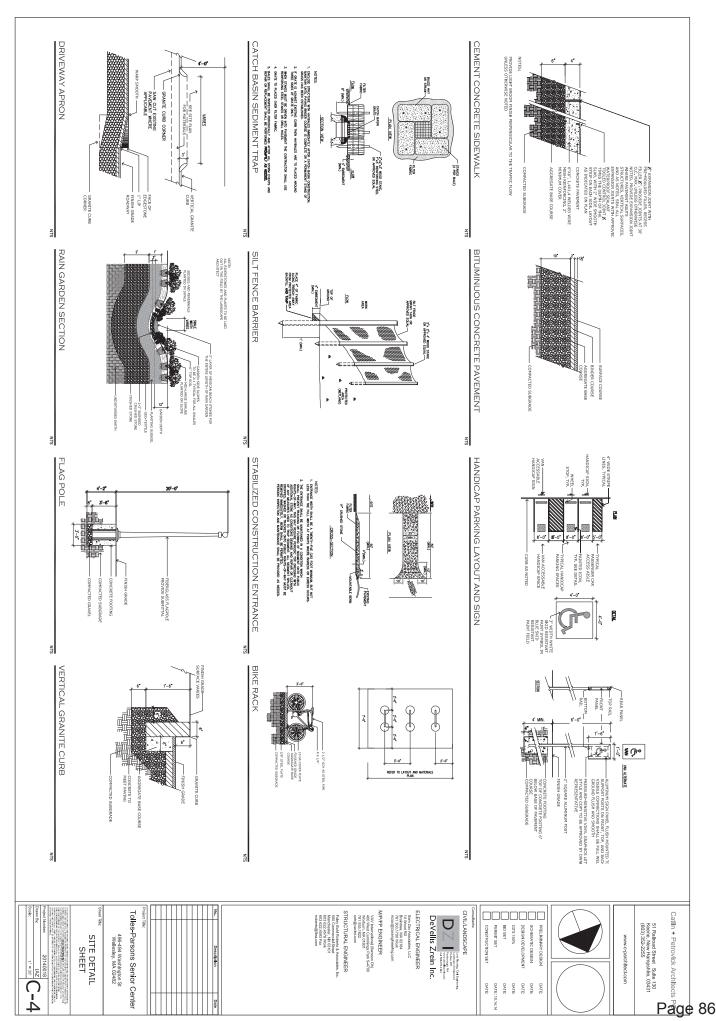












Drainage Report

# **END OF DRAINAGE REPORT**